XARTU/1™ Manual

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Introduction

Overview

The XARTU/1™ Remote Terminal Unit (RTU) is a low-cost version of the XA™ Series family of products. It is an intelligent, compact, rugged, and reliable industrial microprocessor-controlled computer designed for real time remote data acquisition and control applications. It can execute multiple processes including tasks such as complex math functions, control algorithms, etc., without host intervention.

Flexibility, expandability, and reliability are the major factors in the XARTU/1™ design philosophy. It is a balanced system, featuring flexible memory, I/O, power, and communications schemes including support for HEXASCII, MODBUS, and various other custom protocols upon request. A harsh environment tolerance is also one of the XARTU/1™ strengths. The operating temperature can range from -40°C to 70°C (-40°F to 158°F), and the XARTU/1™ is housed in a fiberglass NEMA 4X enclosure. This allows the RTU to exist where the work must be done, eliminating costly signal conditioning or expensive long sensor runs.

The XARTU/1™, normally fed with a 7-30 VDC supply, employs a low-power CMOS design. An optional 120/240 VAC unit includes an uninterruptible power supply. Should it lose power, the RTU will sense the failure, automatically switch to battery power, and continue to operate at full capacity. Other supply options include solar arrays and thermoelectric generators for sites without conventional power.

The standard XARTU/1™ configuration includes one modem port, two serial ports, six analog inputs, and five multi-purpose digital I/O lines. With optional modules, the XARTU/1™ can be expanded to six serial ports and eight analog outputs.

The optional operator interface is a two-line, 32-character liquid crystal display, and 25-key keypad with ten user-definable function keys. This allows users to examine and/or change process data and diagnose problems at the remote site without a local host or terminal.

The XARTU/1™ can calculate natural gas corrected volumes using AGA-3, AGA-5, AGA-7, AGA-8, and NX-19 reports, and is fully compatible with Eagle Research's entire family of products. Eagle Research is committed to providing a complete solution for all gas flow, steam, and control applications.

RELIABILITY

The XARTU/1™ is ruggedly built to perform in a variety of industrial environments. Care is taken to maximize reliability by applying a urethane conformal coating to all circuit boards, utilizing a hermetically sealed keypad and display, and providing NEMA 4X packaging.

Hazardous Location Classifications

The XARTU/1™ is designed and approved for mounting in Class I, Division 2 hazardous area locations (refer to the NFPA Electrical Code Book).

FOUR-YEAR WARRANTY

Eagle Research Corporation® warrants the products it manufactures to be totally free from any defects in materials and workmanship under normal operation and use. Eagle Research® agrees to repair or replace any instrument that is defective due to faulty workmanship or material, if returned to our factory with shipping charges prepaid, within four years of original purchase.

RETURNS

When a faulty product cannot be repaired in the field, contact Eagle Research Corporation for an RMA number and for return information. Packaging and shipping criteria will be established at that time.

> ***IMPORTANT*** REMOVE ANY REPLACEABLE BATTERY OR BATTERY PACK FROM ANY UNIT PRIOR TO ITS RETURN SHIPPING. DAMAGE CAUSED BY LOOSE BATTERIES WITHIN UNITS WILL NOT BE COVERED BY THE MANUFACTURER, AND MAY VOID ANY WARRANTY THE UNIT IS STILL UNDER.

ENCLOSURE SECURITY

Quick-release door latches that may be padlocked are standard features of the XARTU/1™ to prevent unwanted users from opening the enclosure. As an option, a magnetic door-ajar switch may be installed to initiate an alarm when the unit's door is opened.

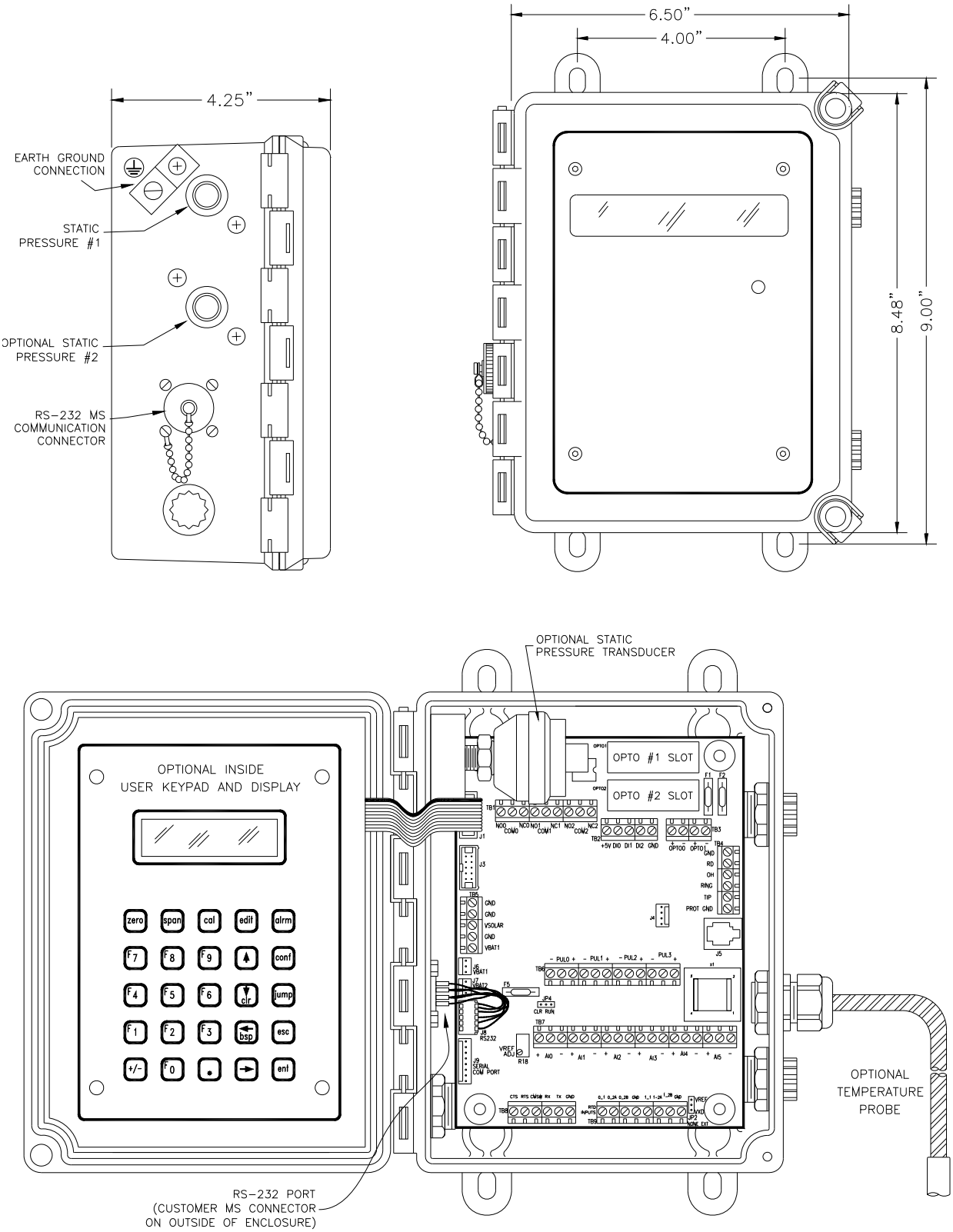


Figure 1 – The XARTU/1™

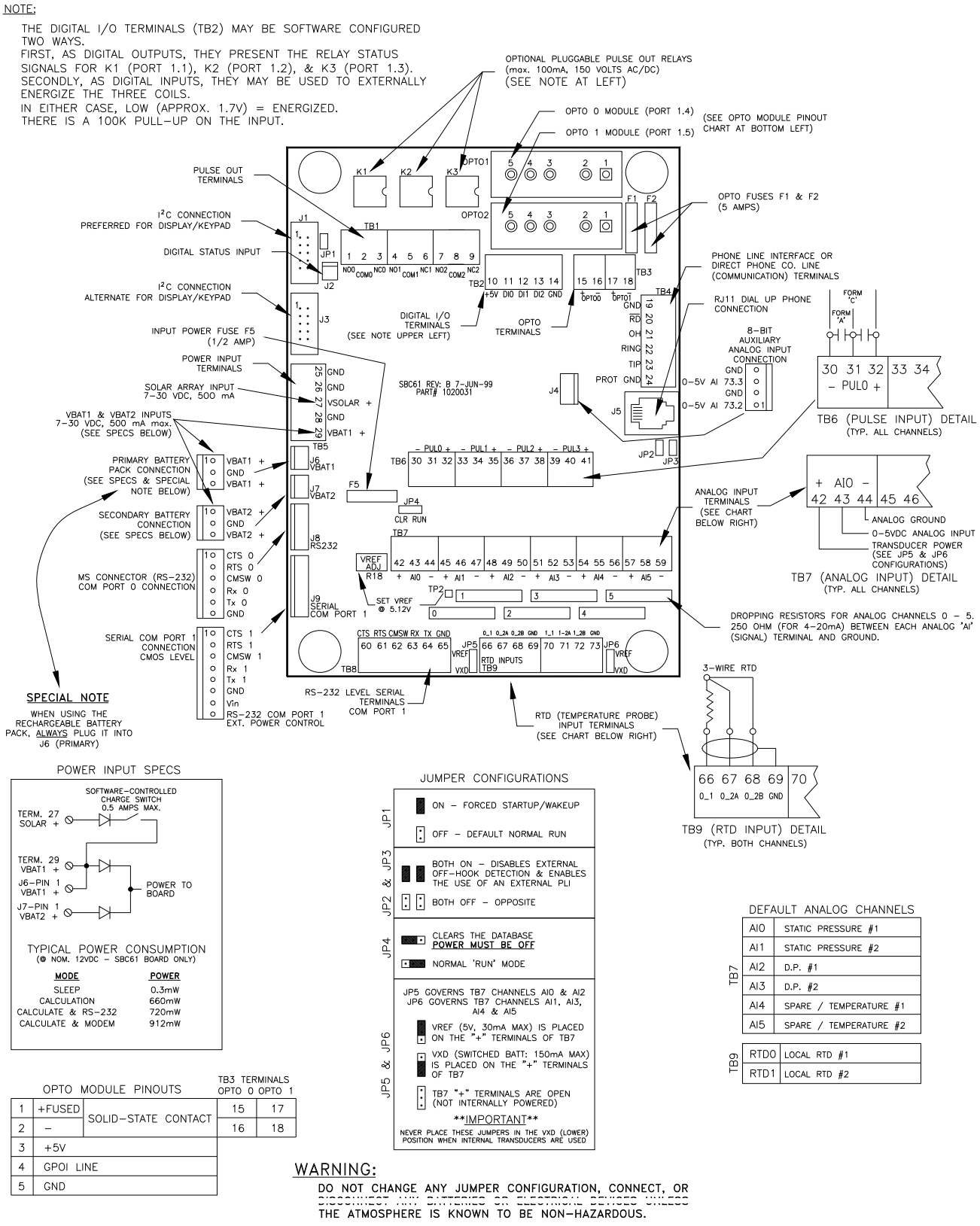

NOTE:
THE DIGITAL I/O TERMINALS (TB2) MAY BE SOFTWARE CONFIGURED TWO WAYS.
FIRST, AS DIGITAL OUTPUTS, THEY PRESENT THE RELAY STATUS SIGNALS FOR K1 (PORT 1.1), K2 (PORT 1.2), & K3 (PORT 1.3). SECONDLY, AS DIGITAL INPUTS, THEY MAY BE USED TO EXTERNALLY ENERGIZE THE THREE COILS.
IN EITHER CASE, LOW (APPROX. 1.7V) = ENERGIZED.
THERE IS A 100K PULL-UP ON THE INPUT.
OPTIONAL PLUGGABLE PULSE OUT RELAYS (max. 100mA, 150 VOLTS AC/DC) (SEE NOTE AT LEFT)
OPTO 0 MODULE (PORT 1.4)
OPTO 1 MODULE (PORT 1.5)
(SEE OPTO MODULE PINOUT CHART AT BOTTOM LEFT)
PULSE OUT TERMINALS
I²C CONNECTION PREFERRED FOR DISPLAY/KEYPAD
DIGITAL STATUS INPUT
I²C CONNECTION ALTERNATE FOR DISPLAY/KEYPAD
INPUT POWER FUSE F5 (1/2 AMP)
POWER INPUT TERMINALS
SOLAR ARRAY INPUT 7-30 VDC, 500 mA
VBAT1 & VBAT2 INPUTS 7-30 VDC, 500 mA max. (SEE SPECS BELOW)
PRIMARY BATTERY PACK CONNECTION (SEE SPECS & SPECIAL NOTE BELOW)
SECONDARY BATTERY CONNECTION (SEE SPECS BELOW)
MS CONNECTOR (RS-232) COM PORT 0 CONNECTION
SERIAL COM PORT 1 CONNECTION CMOS LEVEL
SPECIAL NOTE
WHEN USING THE RECHARGEABLE BATTERY PACK, ALWAYS PLUG IT INTO J6 (PRIMARY)
DIGITAL I/O TERMINALS (SEE NOTE UPPER LEFT)
OPTO TERMINALS
OPTO FUSES F1 & F2 (5 AMPS)
PHONE LINE INTERFACE OR DIRECT PHONE CO. LINE (COMMUNICATION) TERMINALS
RJ11 DIAL UP PHONE CONNECTION
8-BIT AUXILIARY ANALOG INPUT CONNECTION
SBC61 REV: B 7-JUN-99
PART# 1020031
ANALOG INPUT TERMINALS (SEE CHART BELOW RIGHT)
DROPPING RESISTORS FOR ANALOG CHANNELS 0 - 5. 250 OHM (FOR 4-20mA) BETWEEN EACH ANALOG 'AI' (SIGNAL) TERMINAL AND GROUND.
RS-232 LEVEL SERIAL TERMINALS COM PORT 1
RTD (TEMPERATURE PROBE) INPUT TERMINALS (SEE CHART BELOW RIGHT)
TB6 (PULSE INPUT) DETAIL
(TYP. ALL CHANNELS)
TB7 (ANALOG INPUT) DETAIL
(TYP. ALL CHANNELS)
TB9 (RTD INPUT) DETAIL
(TYP. BOTH CHANNELS)
3-WIRE RTD
ANALOG GROUND
0-5VDC ANALOG INPUT
TRANSDUCER POWER (SEE JP5 & JP6 CONFIGURATIONS)
POWER INPUT SPECS
SOFTWARE-CONTROLLED CHARGE SWITCH 0.5 AMPS MAX.
TERM. 27 SOLAR +
TERM. 29 VBAT1 +
J6-PIN 1 VBAT1 +
J7-PIN 1 VBAT2 +
POWER TO BOARD
TYPICAL POWER CONSUMPTION
(@ NOM. 12VDC - SBC61 BOARD ONLY)
MODE POWER
SLEEP 0.3mW
CALCULATION 660mW
CALCULATE & RS-232 720mW
CALCULATE & MODEM 912mW
JUMPER CONFIGURATIONS
JP1
ON - FORCED STARTUP/WAKEUP
OFF - DEFAULT NORMAL RUN
JP2 & JP3
BOTH ON - DISABLES EXTERNAL OFF-HOOK DETECTION & ENABLES THE USE OF AN EXTERNAL PLI
BOTH OFF - OPPOSITE
JP4
CLEARS THE DATABASE POWER MUST BE OFF
NORMAL 'RUN' MODE
JP5 & JP6
JP5 GOVERNS TB7 CHANNELS AI0 & AI2
JP6 GOVERNS TB7 CHANNELS AI1, AI3, AI4 & AI5
VREF (5V, 30mA MAX) IS PLACED ON THE "+" TERMINALS OF TB7
VXD (SWITCHED BATT: 150mA MAX) IS PLACED ON THE "+" TERMINALS OF TB7
TB7 "+" TERMINALS ARE OPEN (NOT INTERNALLY POWERED)
IMPORTANT
NEVER PLACE THESE JUMPERS IN THE VXD (LOWER) POSITION WHEN INTERNAL TRANSDUCERS ARE USED
DEFAULT ANALOG CHANNELS
TB7
AI0 STATIC PRESSURE #1
AI1 STATIC PRESSURE #2
AI2 D.P. #1
AI3 D.P. #2
AI4 SPARE / TEMPERATURE #1
AI5 SPARE / TEMPERATURE #2
TB9
RTD0 LOCAL RTD #1
RTD1 LOCAL RTD #2
OPTO MODULE PINOUTS
TB3 TERMINALS OPTO 0 OPTO 1
1 +FUSED SOLID-STATE CONTACT 15 17
2 - 16 18
3 +5V
4 GPOI LINE
5 GND
WARNING:
DO NOT CHANGE ANY JUMPER CONFIGURATION, CONNECT, OR DISCONNECT ANY BATTERIES OR ELECTRONIC DEVICES UNLESS THE ATMOSPHERE IS KNOWN TO BE NON-HAZARDOUS.

Figure 2 – Processor Board Detail

TECHNICAL SPECIFICATIONS

The table below lists the technical specifications for the XARTU/1™ Remote Terminal Units.

Features	Description
Input Power	7-30 VDC. Two battery inputs on MTA connectors. One power supply / rechargeable battery input on screw terminals. One solar power input on screw terminals
Consumption	5 AH battery, 2-hr charging per day @ 50 mA charge rate. 1 mA average current. Less than 100 uA sleep current
Power Monitoring	Supply voltage monitoring through a/d with low supply voltage Interrupt
Backup Battery	3.6 VDC lithium backup battery: 10 years typical backup of database and time/date during normal use
Processor	Phillips P51XAS3 high performance 16-bit microcontroller running at 22.1184 MHz
Memory	512K x 8 remotely-programmable FLASH program memory 512K x 8 battery-backed RAM data memory
Real time Clock	Battery-backed, quartz crystal controlled; +/- 1 sec/day typical accuracy; programmable time scheduled interrupt capability
Internal Inputs	One ambient temperature input; one supply voltage input
Pulse Inputs	Four pulse inputs, software programmable for Form A or C; high or low speed. Each counter is a six-digit (0-999999) hardware counter with programmable interrupt support. Can be used for simple pulse accumulation, and for more complex applications such as card readers
Digital I/O's	Five multi-purpose memory-mapped digital I/O lines. High-level functionality including pulse inputs, PWM (pulse width modulation) outputs, and complex custom inputs/outputs. Two I/O lines are connected to field terminals through standard OPTO-22 modules. The other three I/O lines can be used as either Form C or A relay outputs (solid state 100 mA max AC/DC) or status inputs (50 V max DC only).
Analog Inputs	Six general-purpose analog inputs, 12-bit resolution, analog sampling, software calibration. Nominal input ranges 0-5.12 VDC. A 250-ohm resistor in socket allows 4-20 mA or 0-5 VDC input for each channel. Each input has three screw terminals (Supply, Signal, and Ground). Supply voltage jumper selectable to connect the switched input voltage or allow connection of an external source or 5 VDC buffered reference.
RTD Inputs	Two 12-bit resolution RTD inputs; 3-wire lead compensated with ground shield connection; four screw terminals per input
Communications	One modem port with extension off-hook detection. Speed up to 2400 baud. Two RS-232 ports with RX, TX, RTS, CTS, and communication switch signals. Configurable speed up to 115,200 baud. Directly interfaces to modems, radios, etc. via 6-position MTA or screw terminals. Communication protocols selectable on a per port basis. Serial ports support external communication devices such as Eagle HexASCII, Modbus, Teledyne/Geotech, and Valmet.
Status LED	One software-controllable LED for various function indications
Expansion Capability	Additional connectors provide redundant termination points to allow for configuration flexibility. Two 10-position connectors allow for expansion over the I^2C communication bus Optional isolated analog output modules and optional serial ports

TERMINAL SUMMARY

Feature	Terminal	XA™ Description	Customer Field Description
PULSE OUTPUTS	01	Normally Open #0	
	02	Common #0	
	03	Normally Closed #0	
	04	Normally Open #1	
	05	Common #1	
	06	Normally Closed #1	
	07	Normally Open #2	
	08	Common #2	
	09	Normally Closed #2	
DIGITAL I/O's	10	+5 VDC	
	11	Digital Input #0	
	12	Digital Input #1	
	13	Digital Input #2	
	14	Ground	
OPTO'S	15	Opto 0 (+)	
	16	Opto 0 (-)	
	17	Opto 1 (+)	
	18	Opto 1 (-)	
MODEM	19	Ground	
	20	Ring Detect	
	21	Off Hook	
	22	Ring	
	23	Tip	
	24	Protective Ground	
POWER INPUT	25	Ground	
	26	Ground	
	27	Solar Input (7-30 VDC)	
	28	Ground	
	29	DC Input (7-30 VDC)	
PULSE INPUTS	30	Pulse 0 Low -	
	31	Pulse 0	
	32	Pulse 0 High +	
	33	Pulse 1 Low -	
	34	Pulse 1	
	35	Pulse 1 High +	
	36	Pulse 2 Low -	
	37	Pulse 2	
	38	Pulse 2 High +	
	39	Pulse 3 Low -	
	40	Pulse 3	
	41	Pulse 3 High +	
ANALOG INPUTS	42	Analog Power (VREF, VXD)	
	43	Analog Input 0	
	44	Ground	
	45	Analog Power (VREF, VXD)	
	46	Analog Input 1	
	47	Ground	
	48	Analog Power (VREF, VXD)	
	49	Analog Input 2	
	50	Ground	
	51	Analog Power (VREF, VXD)	
	52	Analog Input 3	
	53	Ground	
	54	Analog Power (VREF, VXD)	
	55	Analog Input 4	
	56	Ground	
	57	Analog Power (VREF, VXD)	
	58	Analog Input 5	
	59	Ground	
RS-232 SERIAL	60	Clear To Send	
	61	Request To Send	
	62	Communications Switch	
	63	Receive	
	64	Transmit	
	65	Ground	
RTD INPUTS	66	RTD 0-1	
	67	RTD 0-2A	
	68	RTD 0-2B	
	69	RTD GND	
	70	RTD 1-1	
	71	RTD 1-2A	
	72	RTD 1-2B	
	73	RTD GND	
PHONE	J-5	RJ-11 for Tip & Ring	

XARTU/1™ SOFTWARE ADDRESSING

Description	Terminals	Software Address	Notes
Pulse Outputs			The pulse output channels are the same as the digital I/O channels. Typically, you configure each channel for either pulse output or digital I/O but not for both.
Pulse Output #0	1, 2, & 3	1.1	
Pulse Output #1	4, 5, & 6	1.2	
Pulse Output #2	7, 8, & 9	1.3	
Digital I/O's			The pulse output channels are the same as the digital I/O channels. Typically, you configure each channel for either pulse output or digital I/O but not for both.
Digital I/O #0	11	1.1	
Digital I/O #1	12	1.2	
Digital I/O #2	13	1.3	
Opto Modules			
Opto #0	15 & 16	1.4	
Opto #1	17 & 18	1.5	
Modem Port	19, 20, 21, 22, 23, & 24 J5	Port 0	Cannot be shared
Power Input			Range 7 to 30 VDC
Line Power	29	73.1	Can be read in the Extended System process with address for line power and battery at location 117 and solar at location 122 in EEPROM editor
Battery #1	J6 (VBAT1)	73.1	
Battery #2	J7 (VBAT2)	73.1	
Solar	27	61.8	
Pulse Inputs		Form "A"	Form "C" High Speed
Pulse Input #0	30, 31, & 32	0	0.1 0.0001
Pulse Input #1	33, 34, & 35	1	1.1 1.001
Pulse Input #2	36, 37, & 38	2	2.1 2.001
Pulse Input #3	39, 40, & 41	3	3.1 3.001
Analog Inputs			
Analog Input #0	42, 43, & 44	0	
Analog Input #1	45, 46, & 47	1	
Analog Input #2	48, 49, & 50	2	
Analog Input #3	51, 52, & 53	3	
Analog Input #4	54, 55, & 56	4	
Analog Input #5	57, 58, & 59	5	
RS-232 Serial Port	60, 61, 62, 63, 64, & 65	Port 1	Multi-purpose port
RTD Inputs			
RTD Input #0	66, 67, 68, & 69	6	Range –40° to 160°F
RTD Input #1	70, 71, 72, & 73	7	
Box Temperature	N/A	16	Range –67° to 257°F Can be read in the Extended System process
8-Bit Analogs	J4 (1&2) J4 (3&4)	73.2 73.3	
RS-232	J8		COM0 (Accessible through the military-style MS connector on left side of the unit
CMOS	J9		COM1

INSTALLATION

UNPACKING

1. Thoroughly examine the box to verify it was not damaged in shipping. If you find damage, immediately file a claim with the shipper, as the manufacturer cannot be held responsible for items damaged in transportation and accepted by the customer.

2. Carefully unpack the XARTU/1™ from the shipping container. Verify that the box contains every item listed on the shipping order.

!!! CAUTION !!!
This unit contains certain electronic components that are sensitive to electrostatic discharge (ESD); therefore, proper precautions should be taken during maintenance operations to avoid ESD. It is recommended that the operator first touch the MS connector (RS-232C port) on the left side of the unit to dissipate any accumulated static charge. Additional precautions may be taken in order to minimize the possibility of ESD, including the use of a grounding wrist or ankle strap.

If these precautions are not taken and the unit is subjected to severe ESD, it may revert to its default state. However, the unit will not exhibit any loss of data or degradation of performance.

3. Open the front door by releasing the quick release latches of the enclosure and swinging the door out.

4. Examine the label on the inside right wall of the enclosure. It indicates the configuration and serial number of the RTU.

MOUNTING THE RTU

Note: For Positive Displacement (Index-Mounted) applications, see Appendix C.

The XARTU/1™ mounts directly on a wall or, optionally, on a pipe (see Fig. 3). Mounting feet are provided for wall mounting, and plates with U-bolts are provided for pole mounting. Two-inch rigid iron pipe or conduit is required for pipe mounting. It is recommended that the pipe be placed 18 to 24 inches into the ground in a 6-inch wide sackrete/concrete-filled hole. The length of the 2-inch mounting pipe or conduit will vary according to the site, but typical installations place the RTU at about eye level for ease of operation.

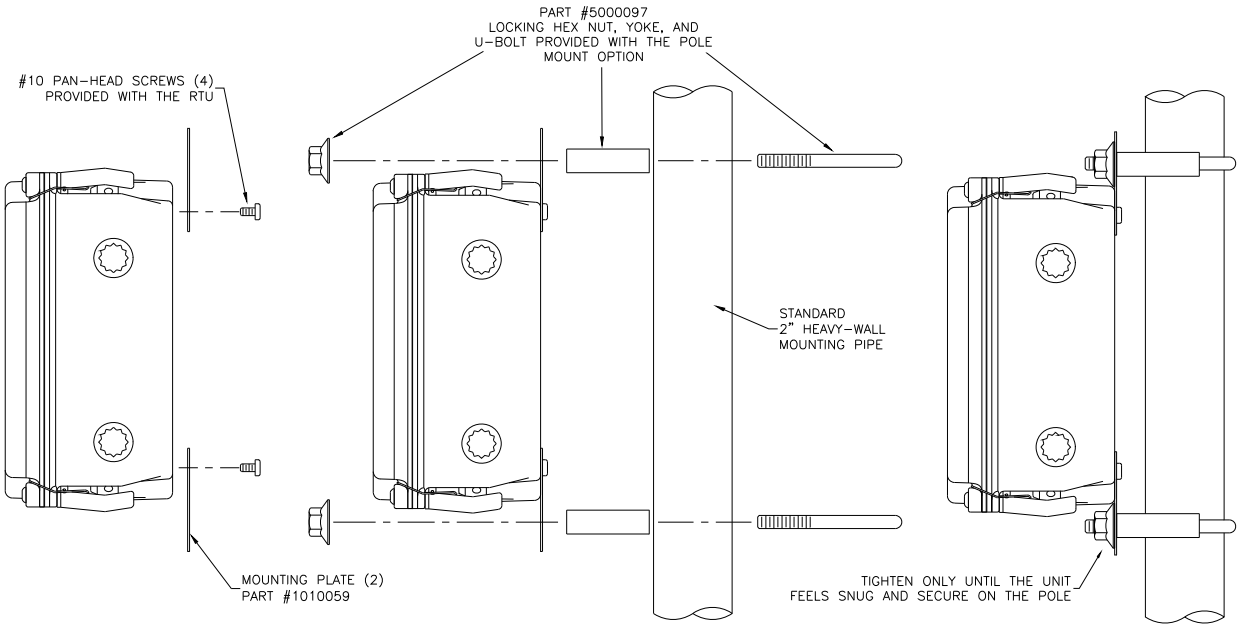


Figure 3 – Pole Mounting Detail

POWER FOR THE RTU

*(Refer to **Figure 2** on page 4 for processor board power connections.)*

POWER OPTIONS

The XARTU/1™ has several power options available: Internal Battery Power Only; External Uninterruptible Power Supply; External Solar Power Array or Supply; or some combination of these. In addition to the primary operating power for the RTU, there is an onboard backup battery to maintain unit memory and clock.

ONBOARD BACKUP BATTERY

The onboard lithium backup battery in the XARTU/1™ maintains power for approximately ten years to the memory section and the real time clock of the processor board when primary operating power is not present. Operation and interactivity with the processor is not available when the backup battery alone is in use.

INTERNAL BATTERY POWER

NOTE
Internal battery packs are <u>not</u> available in units having an internal user keypad.

Several internal battery packs are available for supplying primary power to the RTU. The two basic kinds are **Alkaline** (non-rechargeable) and **Lead-Acid** (rechargeable).

Alkaline packs are typically used alone, without external power, and provide a one-time supply until drained of energy. Alkaline battery life is determined by a number of factors, such as frequency of calculations and communication, cabinet temperature, etc. Connections on the RTU processor board are arranged such that, as one battery pack begins to lose power, a second pack may be connected before the first is removed, thus providing uninterrupted power.

> **WARNING** (see Figure 2) Do not connect the alkaline battery packs to connector J6 or to terminals 28 & 29 when there is an external power supply in use. Damage may occur.

Lead-Acid batteries are rechargeable, and are typically used with an external power supply – such as a solar array or panel. With normal operating conditions, lead-acid batteries and their associated external supplies should provide long periods (up to 10 years) of unattended power to the unit. This would be more suitable for remote locations.

> **CAUTION** (see Figure 2) Do not connect the lead-acid battery packs to connector J7 as charging will not occur.

EXTERNAL POWER SUPPLIES

There are two basic kinds of external power supplies, **Uninterruptible Power Supplies (UPS)** and **Solar Power Supplies (SPS)**. In either case these supplies are designed to be uninterruptible; but the UPS is typically powered by an ac line voltage, where SPS power comes from a solar array. Both types usually have an internal, rechargeable battery that provides power during outages (in the case of UPS), and darkness (in the case of SPS).

Uninterruptible Power Supplies (UPS) are typically fed by a 120- or 240-volt ac supply, providing 9- to 12-volts dc out, and backed by a 2.2 amp-hour (or higher) rechargeable battery. Other forms of energy are available to power a UPS.

Solar Power Supplies (SPS) are fed by a solar array (panel) providing 1 to 64 watts of power to a rechargeable battery. While selected system size depends on geographical location, degree of sun exposure, equipment power consumption, site obstructions, and customer preferences, most RTU applications require only a 10-watt system. Solar systems may be self-contained units mounted independently of the RTU, or simply a local solar array that charges a battery within the RTU enclosure.

WIRING THE POWER INPUT

WARNING
The operating voltage range for the XARTU/1 is 7-30 VDC. Do **NOT** exceed recommended input voltage of 30 VDC.

*(Refer to **Figure 2** on page 4 for processor board power connections.)*

If the unit is **internally battery powered only**, check the type of battery pack being used (it should be a non-rechargeable alkaline) and connect it as follows: Plug it into either J6 or J7 to power up the RTU. When it is time to replace the pack, a second pack may be plugged into the other connector before removing the first so power is not interrupted.

WARNING
Whenever external power is applied to the RTU, **NEVER** plug the non-rechargeable alkaline pack into J6, as damage to the unit may occur.

If the unit is **solar powered** with a local solar array feeding directly into it, follow this procedure. **First -** connect the internal lead-acid (rechargeable) battery pack to J6. **Next** - connect the (+) lead of the solar array to terminal 27 (VSOLAR+) and the (-) lead to terminal 26 (GND). Use the reverse procedure to power the unit down, disconnecting the solar array wires first. Do not connect the internal lead-acid battery to J7, as charging will not occur. **If, for any reason, an alkaline battery pack is used in this application, DO NOT plug it into J6 as damage may occur.**

NOTE
Upon first powering up the RTU, the optional outside display will flash, indicating an alarm condition. In this case it means 'First Time Power', and is no cause for concern. To clear this alarm, read the paragraph on 'Using the Scroll Switch' in the DISPLAY MODE section.

If the unit is **externally powered** by either a UPS or an SPS, remove power from its source, connect its (+) and (-) output wires into terminals 29 (VBAT1 +) and 28 (GND) of terminal block TB5 respectively, and reconnect its source.

When the outside display option is present, you can now view selected parameter values using the scroll switch. The scroll switch is activated by the use of a magnet (one is shipped with units having this option).

You can also change parameter values, view, or acknowledge active alarms using the display and keypad.

The table below shows the terminal wiring for power input.

Power Input Description	XARTU/1™ Terminal Location
Power Input	**TB5**
GND (ground)	25
GND (ground)	26
VSOLAR (solar power)	27
GND (ground)	28
VBAT1	29

INTERNAL CONNECTIONS

COMMUNICATIONS

To communicate with the XARTU/1™, the Site ID in the device must be the same as the Site ID entered in the software package. The Site ID is a unique identification number (1 to 65,535) that allows the software packages to communicate with the XARTU/1™. The default Site ID number is 1. Site ID Changer, available through Talon™ Lite or Talon™ SCADA, can be used to enter a number other than the default. Refer to the respective software User's Manual for additional information on these and other functions. The display and keypad can also be used to change the Site ID from its default value.

In its standard configuration, the XARTU/1™ is equipped with two communications ports – 0 and 1. Port #0 can be configured to allow communication through a modem or RS-232C. Port #1 can be configured for CMOS or RS-232C.

An optional RS-232C serial cable is required for local direct communications. Contact your factory representative for ordering information.

Modem/RS-232C Communications Port #0 (up to 2400 Baud/Modem and 57,600/RS-232)

The internal 2400 Hayes-compatible modem offers automatic answering and dialing. It supports Bell 212A (1200 bps), Bell 103 (300 bps), CCITT V.22 bis (2400 bps), and V.22 (1200 bps). The modem communicates at 2400/1200/300 baud. The modem by itself can only be used in areas classified as non-hazardous or Class I, Division 2. To maintain the XARTU/1's™ intrinsic safety classification in more hazardous areas such as Class I, Division 1, an optional Phone Line Interface (PLI) must be used. This device removes the high voltage ring-detect circuitry from the XARTU/1™ and brings low-level signals into the hazardous area through intrinsic safety barriers. The RS-232C serial port supports Rx, Tx, CTS, RTS, communication switch, and ground signal lines. The J8 6-position MTA connector provides connection for the RS-232 port #0 at a default baud rate of 9,600.

CMOS/RS-232C Communications Port #1 (up to 115,200 Baud)

Port #1 provides a choice of CMOS-level or RS-232C communications connections. Contact your factory representative for more information on this port.

Optional expansion serial port modules can provide four additional serial ports for a total of six. The serial ports may be configured for speeds up to 115,200 baud.

NOTE
Port #0 is dedicated to the modem. Port #1 must be used to flash the unit at 15,200 baud

The tables below show the terminal wiring for the two communications ports.

PORT #0	XARTU/1™ Terminal / Pin Locations
Modem (CMSW pin open)	**TB4**
GND (ground)	19
RD (ring detect)	20
OH (off hook)	21
RING (ring)	22
TIP (tip)	23
PROT GND (protective ground)	24
RS-232C (CMSW pin grounded)	**J8**
CTS 0 (clear to send)	1
RTS 0 (request to send)	2
CMSW 0 (communications switch)	3
Rx 0 (receive)	4
Tx 0 (transmit)	5
GND 0 (ground)	6

PORT #1	XARTU/1™ Terminal / Pin Locations
CMOS (CMSW pin open)	**J9**
CTS 1 (clear to send)	1
RTS 1 (request to send)	2
CMSW 1 (communications switch)	3
Rx 1 (receive)	4
Tx 1 (transmit)	5
GND 1 (ground)	6
Vin	7
RS-232 Port 1 Ext. Power Control	8
R-232C (CMSW pin grounded)	**TB8**
CTS 1 (clear to send)	60
RTS 1 (request to send)	61
CMSW 1 (communication switch)	62
Rx 1 (receive)	63
Tx 1 (transmit)	64
GND 1 (ground)	65

WIRING THE PULSE INPUTS

The standard XARTU/1™ configuration includes four pulse inputs that are software programmable for Form A or C, and high speed or low speed. These inputs can be used for simple pulse counters, or in more demanding applications such as card readers. The table below shows the terminal wiring for the pulse inputs.

Pulse Input Description	XARTU/1™ Terminal Location
Pulse 0	**TB6**
Low 0	30
Pulse 0	31
High 0 (no connection for Form A)	32 (no connection for Form A)
Pulse 1	TB6
Low 1	33
Pulse 1	34
High 1 (no connection for Form A)	35 (no connection for Form A)
Pulse 2	TB6
Low 2	36
Pulse 2	37
High 2 (no connection for Form A)	38 (no connection for Form A)
Pulse 3	TB6
Low 3	39
Pulse 3	40
High 3 (no connection for Form A)	41 (no connection for Form A)

WIRING THE ANALOG INPUTS

The standard XARTU/1™ configuration includes six general-purpose, 4-20 mA or 0-5.12 VDC analog inputs and two RTD inputs with 3-wire lead compensation and ground shield connection. These are 12-bit resolution inputs with analog sampling capability. In addition, there is a box temperature and supply voltage input. All analog inputs can be software calibrated. Jumpers JP5 & JP6 determine the power input to the transmitters. They provide supply voltage (7-30 VDC) when in the down position (VXD), and reference voltage (5.12 VDC) when in the up position (VREF). JP5 governs AI0 & AI2 of TB7, and JP6 governs AI1, AI3, AI4, & AI5. An external supply can also be connected to channels used when the jumper is removed. The table below shows the terminal wiring for the analog inputs.

Analog Input Description	XARTU/1™ Terminal Location
Analog 0 Power 0 Analog Input 0 Ground 0 (no connection for 4-20 mA input)	**TB7** 42 43 44 (no connection for 4-20 mA input)
Analog 1 Power 1 Analog Input 1 Ground 1 (no connection for 4-20 mA input)	**TB7** 45 46 47 (no connection for 4-20 mA input)
Analog 2 Power 2 Analog Input 2 Ground 2 (no connection for 4-20 mA input)	**TB7** 48 49 50 (no connection for 4-20 mA input)
Analog 3 Power 3 Analog Input 3 Ground 3 (no connection for 4-20 mA input)	**TB7** 51 52 53 (no connection for 4-20 mA input)
Analog 4 Power 4 Analog Input 4 Ground 4 (no connection for 4-20 mA input)	**TB7** 54 55 56 (no connection for 4-20 mA input)
Analog 5 Power 5 Analog Input 5 Ground 5 (no connection for 4-20 mA input)	**TB7** 57 58 59 (no connection for 4-20 mA input)
Analog 6 (RTD #0)	**TB9**

0-1 0-2A 0-2B GND	66 67 (jumper 67 to 68 for 2-wire connection) 68 69
Analog 7 (RTD #1) 1-1 1-2A 1-2B GND	**TB9** 70 71 (jumper 71 to 72 for 2-wire connection) 72 73

WIRING THE DIGITAL I/O

The XARTU/1™ comes standard with five multi-purpose, memory-mapped, digital I/O lines. They can be programmed as either inputs or outputs. Digital outputs can be configured as simple discrete outputs, or as precisely timed pulse outputs. Two I/O lines are connected to field terminals through standard OPTO-22 modules. The other three I/O lines can be used as either Form A or Form C relay outputs (solid state 100mA max AC/DC) or status inputs (50 V max DC only).

Digital I/O Description	XARTU/1™ Terminal Location
Pulse Out 0	**TB1**
Normally Open 0 (NO0)	1
Common 0 (Com0)	2
Normally Closed 0 (NC0)	3
Pulse Out 1	**TB1**
Normally Open 1 (NO1)	4
Common 1 (Com1)	5
Normally Closed 1 (NC1)	6
Pulse Out 2	**TB1**
Normally Open 2 (NO2)	7
Common 2 (Com2)	8
Normally Closed 2 (NC2)	9
Digital Inputs	**TB2**
+5V	10
Digital In 0 (DI0)	11
Digital In 1 (DI1)	12
Digital In 2 (DI2)	13
GND	14

The two opto module slots (OPTO1 & OPTO2) can be used as inputs or outputs. The table below shows the wiring for the two opto module slots.

Opto Module Slots Description	XARTU/1™ Terminal Location
Opto 0	**TB3**
High-Level Module 0 (+)	15
High-Level Module 0 (-)	16
Opto 1	**TB3**
High-Level Module 1 (+)	17
High-Level Module 1 (-)	18

OPTIONAL EQUIPMENT

*(Refer to **Figure 2** on page 4 for processor board connections)*

The standard XARTU/1™ is configured to handle the majority of instrument and measurement applications. However, the two 10-position header connectors located in the upper left-hand corner of the XARTU/1™ Processor Board allow for expansion over the I^2C communications bus. The optional isolated analog output (XA-AO™) and serial port (XA-ESP™) boards use this expansion feature.

OPTIONAL ANALOG OUTPUT BOARD (XA-AO™)

The XA-AO™ Analog Output Board and connecting cable provides a two-channel, two-wire, loop-powered, optically isolated, precision 4-20mA output. This module interfaces with the XARTU/1™ to provide 4-20mA outputs for flow rate, pressure, or numerous other control and monitoring applications. Typically, one XA-AO™ board is mounted internally. But a maximum of eight can be externally mounted and controlled by the XARTU/1™. For this purpose, the AO board has its own custom enclosure for surface mounting.

Power for the digital interface section of the AO is selectable by using the DIP switches, and can be supplied by Vcc of the XARTU/1™, or from the main supply voltage. The AO board interfaces to the XARTU/1™ series product via the standard I^2C serial interface bus. The XARTU/1™ unit requests the desired mA output from the AO board using this bus. An I^2C digital I/O chip is used to send the information to the analog output section of the AO board.

The analog output section of the board derives its power from the current loop, and is optically isolated from the digital control interface section. The analog output section receives commands from the digital I/O chip through opto-isolators. Commands are in the form of a serial data stream. The AO board provides 4-20mA output signals with a resolution of 1 part in 65536 (16 bit), or 0.00024mA. The D/A also allows for over-ranging of the output to a minimum of 3.5mA and a maximum of 24mA. The field interface to the D/A is a simple two-wire connection. Reverse polarity protection is provided.

The XA-AO™ will function properly in temperatures from –40°F to +160°F, and in conditions of high humidity (including condensing environments). Software calibration of the 4-20 mA output is provided for easy calibration.

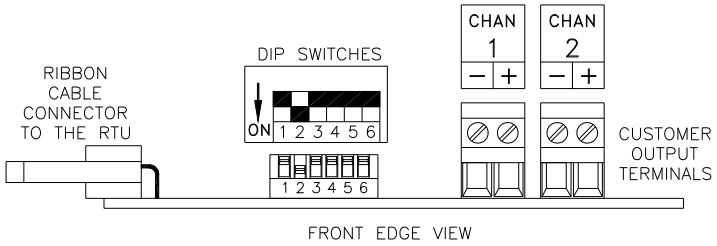


Figure 4 – XA-AO Analog Output Board

XA™ Analog Output Specifications

Description	Specifications
Environmental	
Operating Temperature	-40°F to +160°F
Operating Humidity	0 to 100%
Electrical Isolation	500 V DC or AC RMS (sine wave) between digital interface and 4-20 mA loop
Current Loop Output	
Maximum Output Current	24mA
Minimum Output Current	3.5mA
Maximum Supply Voltage	50V
Minimum Supply Voltage	8V
Resolution	16 bits, 0.00024 mA
Full Scale %Error (software calibrated at 4 and 20 mA and tested at room temperature)	±0.01% max
Temperature Drift	±0.00044 mA/°F max
Error caused by RFI	<1% of span shift with 2.8W 150MHz applied at 1.7'
Digital Control Interface	
Vcc Powered Input Current	10 uA max in idle mode; 15 mA max during communications
Vin Powered Input Current	30 uA higher than with Vcc power typical
Communications Interface	I^2C as described for the Phillips PCF8575 digital I/O chip
Physical	
Width with mounting tabs	4.75"
Width without mounting tabs	3.78"
Height	2.143"
Depth	0.688"

Wiring the Analog Output Loop

The external wiring to the AO board is very simple. A ribbon cable connects the AO board to the XARTU/1™. Commands are sent to the board via the cable by the XARTU/1™ device. The 4-20mA current loops are simple two-wire connections. +24 VDC nominal is connected to the "**+**" terminal, and the "**-**", or return terminal, is connected to the field instrument to which the 4-20mA signal is being sent.

Optional Serial Port Board - XA-ESP™

The XA-ESP Expansion Serial Port board provides an additional serial port to communicate with the XARTU/1™. Up to four additional XA-ESP™ boards may be connected to the XARTU/1™. Combined with the two onboard ports, a total of six is possible. Like the XA-AO™ board described earlier, this board may be externally surface mounted in its own enclosure.

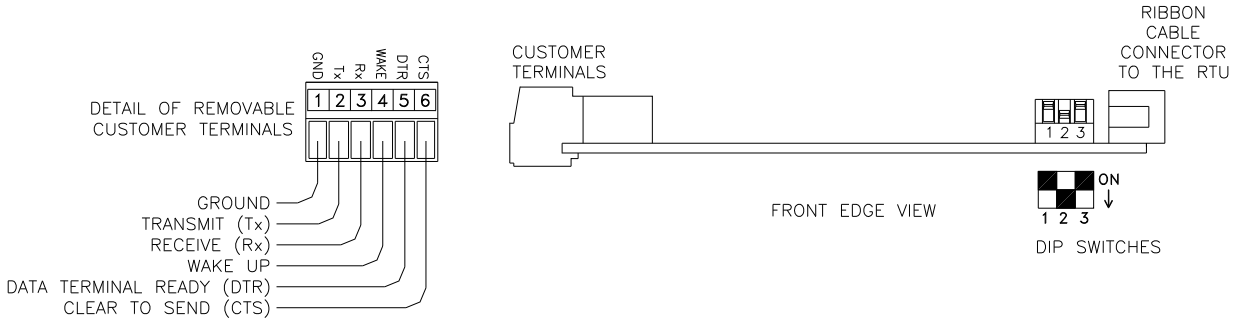


Figure 5 – XA-ESP™ Expansion Serial Port Board

OPTIONAL USER KEYPAD AND DISPLAY

Another useful option to the XARTU/1™ is a factory-mounted keypad and display. The keypad and display may be used to access, change, and view programming data and stored information while on site. The display feature may be internally and/or externally mounted. When external, the display alone may be viewed from outside the unit without opening the door. When internal, the display is combined with an interactive keypad (see Fig. 6). Use of the keypad and display will be discussed in detail in the section on OPERATING MODES.

Handheld Keypad and Display

For units without the factory mounted keypad and display option, a rugged, portable keypad and display may be plugged in to the unit's processor board and used just like the factory-mounted model. Contact your sales representative for more information on this option.

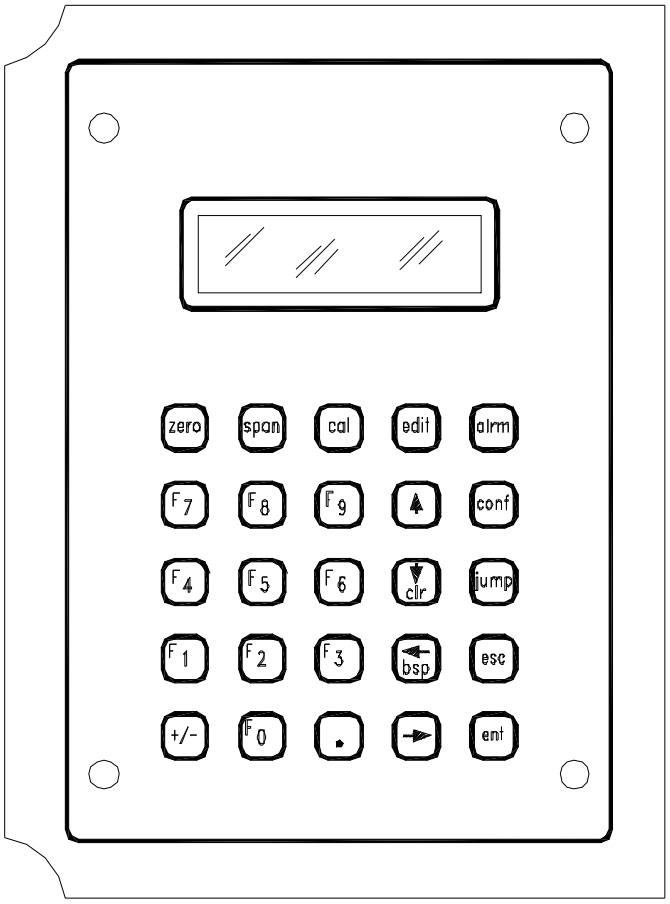


Figure 6 – Optional Keypad and Display

GROUNDING

Because of the potential for equipment damage and injury to personnel, certain practices should, and often must, be observed when installing RTU systems. Of these practices, proper grounding is possibly the single most important. This section was included to point out general rules and practices, and *NOT* to supersede those defined in the **National Electrical Code** (NEC) published by the National Fire Protection Association (NFPA), nor the **Classification of Gas Utility Areas for Electrical Installations** booklet published by the American Gas Association (AGA). A sound understanding of Federal, State, and Local laws is fundamental to proper and legal installation work. Eagle Research Corporation makes no warranties or guarantees on the effectiveness or safety of any technique or suggestion here described.

All RTU, electronic utility interface, and gas meter equipment should be kept at the same ground potential so that unexpected voltages anywhere on the system are quickly shunted away to earth. This calls for a common ground rod (or "bed" of grounding materials) to which is securely tied all equipment chassis, metal cabinets, and intrinsic safety ground brackets. For equipment chassis and metal cabinets, a solid copper ground wire or ground strapping of an approved size and type is recommended to tie this equipment to the rod(s). For Intrinsic Safety systems it is recommended that two #12 AWG wires be run in parallel from individual ground terminals on each I.S. ground frame. Where more than one rod is used, as when some distance separates equipment, all rods should be bonded together with copper in an approved manner.

References

- National Electrical Code
  - Article 250 - Grounding
  - Articles 500 & 501 - Hazardous (Classified) Locations
  - Article 504 - Intrinsically Safe Systems
- The IAEI Soares' Book on Grounding
- PolyPhaser Corp.'98 catalog of Lightning/EMP & Grounding Solution

OPERATING MODES

The RTU operates in any of the following five standard modes:

- Sleep/Wake-up
- Display
- Alarm
- Configuration
- Calibration

To access any operating mode, press the keypad key that corresponds to the mode you want:

conf	for configuration mode
alrm	for alarm mode
cal	for calibration mode
esc	to return to a previous mode from any other mode

SLEEP/WAKE-UP MODE

In normal operation the XARTU/1™ maintains a powered down state (sleep mode) to conserve battery life. In this state the internal display is blank while the outside display shows the first label, **CV XXXXXXXX** for example, where **XXXXXXXX** is the most recent reading prior to the next wake-up interval. The unit executes processes depending upon the user's programmed wake-up interval. Shorter intervals result in more frequent data while longer intervals provide for longer battery life. The scheduled wake-ups result in immediate power-down after performing calculations.

In addition to the scheduled wake-ups for volumetric calculations, the XARTU/1™ can be brought up from its sleep mode by any of the following:

- Connecting a portable computer to the unit's serial communication port (MS connector)
- Pressing any key on the keypad
- Scrolling the external display with a magnet (see the section on DISPLAY MODE)
- Calling the unit via modem

Once the unit is awake, it will automatically power down one minute after the operator stops interacting with it. The RTU can also be forced to enter the sleep mode by pressing the **ent** and **zero** keys simultaneously.

> **NOTE**
> The XARTU/1 will not go to sleep if the RS-232C serial cable is connected. Battery life, in this case, may be drastically reduced.

Typically, the RTU remains fully awake and does not enter the sleep mode if it is powered with an external power supply. In this case, the **Wake-up Interval** parameter is set to **0**.

DISPLAY MODE

In display mode, only limited parameters with assigned labels and function keys can be viewed. With the optional keypad and display, the ▪ and ▪▪arrow keys will allow you to scroll through the display parameter list. You may use the **jump** key to directly view any of the assigned labels; press **jump** then enter the label number 1-64, followed by pressing **ent**. You can use the function keys (**F0 - F9**) to view previously assigned parameters. Talon Device Manager or Talon SCADA software can be used to assign function keys and labels to any parameter. Also, the local keypad may be used to assign function keys.

Using the Scroll Switch

On units that feature the external display, a magnet may be used to easily access information without opening the door. Just below the display window, either on the left or right, is a routed indention in the door. When the key chain magnet, supplied with these units, is held in the proximity of this 'dimple', the display will vary its information. Each subsequent pass of the magnet over this dimple will produce a new parameter display.

When in an alarm condition, the external display will be flashing. To clear alarms, hold the magnet against the dimple until flashing stops.

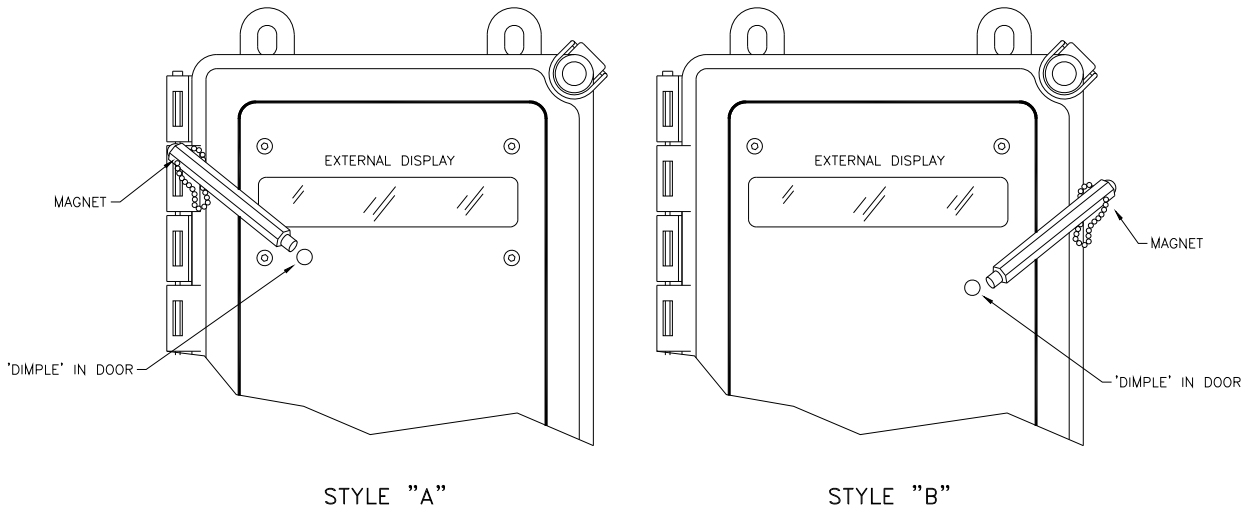


Figure 9 – Using the Scroll Switch Feature

ALARM MODE

The XARTU/1™ can be configured to activate an alarm when certain conditions are met or when user-defined limits are exceeded. Active alarm messages can be configured to show on the RTU's display. The unit can also automatically call a host computer running Field Manager™ and the Talon™ Software Suite to report the alarm. (see the section on SOFTWARE PACKAGES).

A history log is kept in the RTU on each alarm condition, consisting of the following:

- Current value
- Type of alarm (high, low, etc.)
- Setpoint value (alarm limit)
- Time of alarm
- Date of alarm
- Time out of alarm
- Date out of alarm
- Extreme value alarm

The RTU can be configured to monitor and alarm on any condition including, but not limited to, the following:

- First Time Power
- AC Power Failure
- Low Supply Volts
- High and Low Flow Rate
- High and Low Pressure
- High and Low Differential Pressure
- High and Low Temperature
- Current Day Flow (Transportation Limit)
- Low Voltage Shutdown
- Box intrusion

> **NOTE**
> Additional hardware equipment and configuration may be required for some alarm monitoring applications.

Viewing and Clearing Alarms from the Keypad

(See the sections on ALARM MODE, & APPENDIX A: PARAMETER TABLES)

To enter alarm mode, press the **alrm** key on the optional keypad. In alarm mode you can view and acknowledge any alarm. If alarms are active, the unit will display the first alarm message. If there are more alarms, you can view them by pressing the ▪ key. Repeatedly pressing the ▪ key cycles through the active alarm list.

Alarms can be locally acknowledged at the RTU by pressing the **ent** key while a particular alarm message is displayed, or by polling with Talon™ Lite or Talon SCE™ software.
When in an alarm condition, the optional external display will be flashing. To clear alarms, hold the magnet against the dimple until flashing stops.

Unless the parameter's limits are violated again, the unit will not include acknowledged alarms in its list the next time the user enters alarm mode. To exit alarm mode without acknowledging the alarm, simply press the **esc** key.

First Time Power Alarm

First Time Power alarm is defined as the re-application of power after interruption of the power source. For example, whenever the battery is disconnected and then subsequently reconnected, the unit records the First Time Power event.

Low Supply Volts Alarm

If the supply voltage to the unit falls below the Low Supply Volts Alarm Setpoint value, a **Low Supply Volts** alarm will be initiated. The alarm will remain active until the supply voltage is greater than the Low Supply Volts Alarm Reset parameter. The setpoints are user configurable with default values of 8.5 and 8.8 volts respectively for battery powered units.

High Flow Rate Alarm

If the flow rate should exceed the High Flow Rate Alarm Setpoint, a **High Flow Rate** alarm will be initiated. The alarm will remain active until the flow rate falls below the High Flow Rate Reset parameter value. The setpoints are user configurable with default values of 100000 and 99990 respectively.

Low Flow Rate Alarm

If the flow rate should fall below the Low Flow Rate Alarm Setpoint, a **Low Flow Rate** alarm will be initiated. The alarm will remain active until the flow rate rises above the Low Flow Rate Reset parameter value. The setpoints are user configurable with default values of -100 and -80 respectively.

High Pressure Alarm

If the gas pressure should exceed the High Pressure Alarm Setpoint, a **High Pressure** alarm will be initiated. The alarm will remain active until the pressure falls below the High Pressure Reset parameter value. The setpoints are user configurable with default values of 1500 and 1480 respectively.

Low Pressure Alarm

If the gas pressure should fall below the Low Pressure Alarm Setpoint, a **Low Pressure** alarm will be initiated. The alarm will remain active until the pressure rises above the Low Pressure Reset parameter value. The setpoints are user configurable with default values of -100 and -80 respectively.

High Differential Pressure Alarm

If the differential pressure should exceed the High Differential Pressure Alarm Setpoint, a **High Differential Pressure** alarm will be initiated. The alarm will remain active until the differential pressure falls below the High Differential Pressure Reset parameter value. The setpoints are user configurable with default values of 1500 and 1480 respectively.

Low Differential Pressure Alarm

If the differential pressure should fall below the Low Differential Pressure Alarm Setpoint, a **Low Differential Pressure** alarm will be initiated. The alarm will remain active until the differential pressure rises above the Low Differential Pressure Reset parameter value. The setpoints are user configurable with default values of -100 and -80 respectively (see the Appendix Tables on page **43** for parameter addressing for your device).

High Temperature Alarm

If the gas flow temperature should exceed the High Temperature Alarm Setpoint, a **High Temperature** alarm will be initiated. The alarm will remain active until the temperature falls below the High Temperature Reset parameter value. The setpoints are user configurable with default values of 200 and 180 respectively.

Low Temperature Alarm

If the gas flow temperature should fall below the Low Temperature Alarm Setpoint, a **Low Temperature** alarm will be initiated. The alarm will remain active until the temperature rises above the Low Temperature Reset parameter value. The setpoints are user configurable with default values of -100 and -80 respectively.

Current Day Flow Alarm (Transportation Limit)

If the current day's total volume should exceed the Current Day High Volume Alarm Setpoint, a **Current Day Flow** alarm will be initiated. The alarm will remain active until the value for the current day volume is reset the next day at roll time. The setpoints are user configurable with default values of 100000 and 99990 respectively. For transport or interruptible customers, this parameter can be used to alarm when an account has exceeded a predetermined daily volume allocation.

Low Voltage Shutdown Alarm

If the supply voltage should fall to approximately 6.0 volts, an interrupt will be triggered and the unit will enter Low Voltage (Critical) Shutdown mode. **Low Batt** will be displayed on the display. This is an indication that the supply voltage is absolutely too low to operate the unit properly. The battery must be changed at this point or adequate supply voltage applied. In this mode, all operation ceased, and the unit operates in a protective mode. The on-board battery will continue to protect the unit's memory; therefore data prior to entering this mode will be maintained. The supply voltage is monitored constantly and the unit will reset itself should the supply voltage becomes greater than 6.0 volts. If the unit is left alone without applying adequate supply voltage, the battery will continue to drain and the outside display will eventually go blank.

When sufficient supply voltage is applied and the unit is powered up, a **Low Voltage Shutdown** alarm will be recorded.

Box Intrusion Alarm (Optional door ajar switch)

The **Box Intrusion** alarm is initiated when the door of the XARTU/1™ opens. When this occurs, a full wake-up is triggered and the unit executes its processes. The alarm is inactive when the door is closed.

CONFIGURATION MODE

Configuration mode allows you to set up the XARTU/1's™ initial configuration, change any of the operating parameter values, and set alarm conditions and limits. Talon™ Lite software, Talon™ SCADA software, or the optional internal or handheld keypad and display is required to perform configuration. See the Talon™ software online help files for operating instructions. A Utility software package is supplied with your unit consisting of Virtual Keypad and other utilities.

> ***CAUTION***
> **Care must be taken when editing parameters. Improper parameter editing may result in corruption of the database.**

To enter configuration mode, press the **conf** key on the optional keypad. If the configuration mode is password protected, the RTU will display **ENTER PASSWORD?** Only a valid password entry would then be given access to this mode. Configuration mode allows you to set up the RTU's initial configuration, change any of the operating parameter values, set alarm conditions and limits, and assign function keys to various parameters. While in the configuration mode, the RTU continues to operate normally. It continues to sample live pressure and temperature values, calculate corrected volume, and collect historical data.

Viewing Parameters

In configuration mode, any parameter value may be viewed. One method is to use the **Jump** key to directly view database items. Press **Jump** and then enter the address of the parameter **(PPSSII)** followed by pressing the **ent** key. The top line on the display is the address **XX-XX-XX** and the bottom line is the value. Function key assignments are still valid, so often-viewed parameters may be accessed in this manner. The right and left arrow keys **▪▪←→▪)** allow horizontal movement between processes, and the up and down arrow keys **▪▪▪▪▪▪▪** allow moving vertically within a process. Pressing **Jump** followed by the right arrow key **(→▪▪**will display the same item number in the next section. Likewise, pressing **Jump** followed by the up arrow key **(▪▪** will display the same item number in the previous section. Jumping to assigned labels is also supported as described in Display mode.

Editing Parameters

1. Enter configuration mode by pressing the **conf** key (use the password if required).
2. Display the desired parameter. Press the **jump** key, followed by the address of the parameter. The function keys can also be used to view assigned parameters.
3. With the desired parameter displayed, press the **edit** key. (The unit will display the current parameter value and prompt for a new value.) Use the keypad to enter the correct value and then press the **ent** key to execute the change. Pressing the **esc** key when the RTU prompts for the new value will abort the change. Pressing the **ent** key if nothing has been typed, also leaves the parameter unchanged.

Assigning Function Keys

In configuration mode, any item can be assigned to a function key as follows:

1. Enter configuration mode by pressing the **conf** key (use the password, if required).
2. Display the desired parameter. Press & release the **jump** key, followed by the address of the parameter.
3. Assign a function key to the parameter. Press & release the **jump** key, then the **edit** key, and then the function key you wish to assign to the current item [**F0 - F9**].

Audit Trail

The RTU maintains an electronic audit trail file that records all parameter changes and calibrations performed on the unit. Each entry is identified with the date and time the event occurred. The contents of this file cannot be changed, providing a secure, non-editable audit trail.

In the standard RTU configuration, the audit trail is disabled. You can enable audit trail logging by editing address 010313 to **300** at the keypad or by using Talon Device Manager or Talon™ SCADA software. The maximum memory allowed for audit trail is (300 records * 24 = 7,200).

NOTE
Once the audit trail is enabled (a value greater than "0"), the user cannot disable it without a full unit initialization. Reloading the database will not disable the audit trail.

Once enabled, the RTU maintains the audit trail file with a maximum of 300 records. You can upload the information from the unit to a portable or host computer using Talon Device Manager or Talon SCADA software. When the audit trail is full, **Audit Trail Full** will appear if editing is attempted and the RTU will not allow any changes. The audit trail must first be uploaded and reset by Talon Device Manager or Talon SCADA software.

Memory (History Logging)

The XARTU/1™ has a minimum of 512K x 8 Z-RAM for database, audit trail, and history logging, and 512K x 8 Flash memory allowing easy upgrade of run-time code. With the large memory capacity, a minimum of 32,000 historical inputs with time and date stamp can be stored. The non-editable history file provides the user with time related data logged in any variation of selectable intervals; minute, daily, weekly, and monthly. An event-driven history mode allows the logging of data when an event occurs (e.g. alarms). An experienced user with Talon SCADA software can define the type of data and collection period. Since the history data elements are stored in a block of memory, the size has to be assigned at the time the history process is created in the RTU; typically when the database is downloaded at the factory.

NOTE
The size of the history block cannot be changed once the history process has been created in the unit. A complete download would be required to reset the database and change the RTU's memory assignment.

The memory required to store an entire history process data block is [Max pointers * (Max Record +1) *4].

Data may be collected over the telephone lines via the optional modem, or on-site through the MS connector on the side of the enclosure. Talon Lite™ or Talon™ SCADA software is required for collection. The collected data can then be used for:

- Billing information
- Measurement reports for utility and customer management
- System analysis using flow rate and pressure
- Support for estimating gas volume consumption in cases of meter or instrument malfunction

Configuring Four Parameters for Display

This feature allows the user to configure four parameters that can be shown simultaneously on the display. It is helpful when troubleshooting the unit. The parameters must be configured before they can be displayed. To configure and display the four parameters:

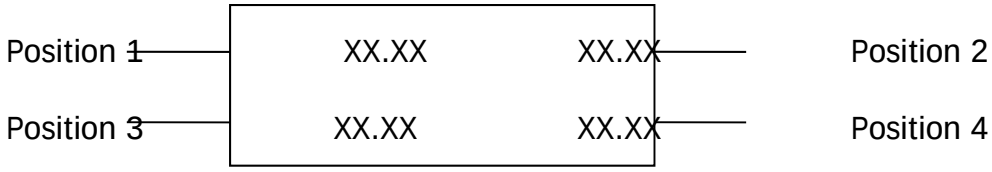
1. View the first parameter to be configured as defined in APPENDIX A.

2. Press the **jump** key followed by the blue **zero** key. The RTU will display:

Select 1234 for
XX-XX-XX

Where **XX-XX-XX** is the address for the parameter.

3. Press the number **1, 2, 3 or 4** for the desired positioning of the parameter.



4. View the second, third, and fourth parameters and follow steps 2 and 3 above.

5. Press the decimal point key (•) while in configuration mode to display the values of all four parameters. Pressing the decimal point key (•) a second time will show the address for the four parameters.

6. Press the decimal point key (•) a third time to exit to configuration mode.

Special Key Combinations

There are a number of special key combinations that allow the user to view system information and perform certain tasks very easily. These are listed in the table below.

Key Combination	Description
+ / - and **zero**	System Passwords
• and **cal**	System information (ROM version, unit S/N, calculated Checksum)
→ and **edit**	Toggles keypad beeper on and off

CALIBRATION MODE

Calibration mode allows the user to calibrate the analog inputs such as differential pressure, static pressure, and temperature. While operating in the calibration mode the RTU continues to periodically update volume. The analog input value used for calculations is the value measured when calibration mode was initially entered. Once in calibration mode, the user can perform the following operations:

- Calibrate **zero** only
- Calibrate both **zero** and **span**
- Calibrate **zero shift** for the DP transmitter

Of course, the option to change the calibration reference points is available at all times. Several other features make the software calibration routine attractive and more intuitive. In the XARTU/1™, unit calibration is software based; there is no need for laborious operator adjustments. Software calibration does away with the need for repetitive potentiometer adjustments, thereby simplifying field calibration procedures.

Calibrating Static Pressure and Temperature Transmitters

1. View the value of the transmitter to be calibrated on the display. The function keys can be used for quick access.

2. Press the blue **cal** key. Enter your password at the optional **PASSWORD?** prompt, if required.

3. The RTU will enter calibration mode. The display will alternate between **CALIBRATING** and the parameter label; **PRESSURE #1** for example.

4. Apply the zero reference to the transmitter and wait for the reading to stabilize.

5. Press the blue **zero** key. The display now shows the following:

   ZERO> XX.XX
   NEW?>

   Where **XX.XX** represents the unit's default zero value. If the current zero reference matches the unit's default, simply press the **ent** key to collect the new point. Otherwise, key in the value of the current reference before pressing the **ent** key. The unit should display **Calculating . . .** briefly, and then display the new point. Pressing the **esc** key instead of the **ent** key at this point aborts the operation and returns you to the calibration prompt.

6. Apply the span (full-scale) reference to the transmitter and wait for the reading to stabilize.

7. Press the blue **span** key. The unit now shows:

   SPAN> XX.XX
   NEW?>

   As with the zero point, if the external reference matches the default span value, simply press the **ent** key. Otherwise, key in the current value of the external reference, then press **ent**. After the **ent** key is pressed, the display reading should immediately adjust to reflect the new calibration point. Pressing the **esc** key instead of **ent** at this point aborts the operation and returns the operator to the calibration prompt.

8. Steps 4 through 7 are required only once. They may be repeated as often as necessary while in calibration, but only the most recent point will be saved on completion of calibration.

9. To permanently store the results of the calibration press the **ent** key, and the unit will prompt, **Enter to accept Calibration**. Simply press the **ent** key again to save the calibration. Press the **esc** key to abort the calibration. (Note: Pressing **esc** repeatedly from anywhere within the calibration procedure will back the operator out of calibration mode).

Calibrating Differential Pressure (DP) Transmitters

Before beginning, bleed off the pressure from the static pressure transmitter, and from the high and low ports of the DP.

1. View the value of the transmitter to be calibrated on the display. The function keys can be used for quick access.

2. Press the blue **cal** key. Enter your password at the optional **PASSWORD?** prompt, if required.

3. The RTU will enter calibration mode. The display will alternate between **CALIBRATING** and the parameter label; **DIFF PRESS H2O** for example.

4. Apply the zero reference to the transmitter and wait for the reading to stabilize.

5. Press the blue **zero** key. The display now shows the following:

   ZERO> XX.XX
   NEW?>

   Where **XX.XX** represents the unit's default zero value. If the current zero reference matches the unit's default, simply press the **ent** key to collect the new point. Otherwise, key in the value of the current reference before pressing the **ent** key. The unit should display **Calculating . . .** briefly, and then display the new point. Pressing

the **esc** key instead of the **ent** key at this point aborts the operation and returns you to the calibration prompt.

6. Apply the span (full-scale) reference to the 'high' port on the DP transmitter and wait for the reading to stabilize.

7. Press the blue **span** key. The unit now shows:

SPAN> XX.XX
NEW?>

As with the zero point, if the external reference matches the default span value, simply press the **ent** key. Otherwise, key in the current value of the external reference, then press **ent**. After the **ent** key is pressed, the display reading should immediately adjust to reflect the new calibration point. Pressing the **esc** key instead of **ent** at this point aborts the operation and returns the operator to the calibration prompt.

13. Steps 4 through 7 are required only once. They may be repeated as often as necessary while in calibration, but only the most recent point will be saved on completion of calibration.

14. To permanently store the results of the calibration press the **ent** key, and the unit will prompt, **Enter to accept Calibration**. Simply press the **ent** key again to save the calibration. Press the **esc** key to abort the calibration. (Note: Pressing **esc** repeatedly from anywhere within the calibration procedure will back the operator out of calibration mode).

15. The RTU will now enter the **zero shift** calibration mode for the DP transmitter. The display will alternate between the following:

- ZERO SHIFT CAL
- DIFF PRESS H20 (example parameter label)
- APPLY LINE PRESS
- EQUALIZE DP
- PRESS ZERO
- TO ADJUST
- clr TO DISABLE
- ent TO ACCEPT
- esc TO ABORT

11. Apply line pressure to the static pressure transmitter and to the DP transmitter's 'high' and 'low' ports.
12. Wait for the reading to stabilize and press **zero** to set the zero shift compensation. (Press **clr** to disable zero compensation if needed)

13. To permanently store the results of the calibration press the **ent** key, and the unit will prompt, **Enter to accept Calibration**. Simply press the **ent** key again to save the calibration. Press the **esc** key to abort the calibration. (Note: Pressing **esc** repeatedly from anywhere within the calibration procedure will back the operator out of calibration mode).

Calibrating the Optional Analog Output Board

Several features make the Analog Output software calibration routine attractive and more intuitive. In the XARTU/1™, unit calibration can be software based; there is no need for laborious operator adjustments. Software calibration does away with the need for repetitive potentiometer adjustments, thereby simplifying field calibration procedures. The keypad/display or Talon Device Manager software is necessary to perform software calibration.

NOTE
Pressing **esc** repeatedly from anywhere within the calibration procedure will back the operator out of calibration mode.

1. Display the Analog Output parameter on the display.

2. Press **cal**. Enter your password at the optional **PASSWORD?** prompt, if required.

3. The unit will enter calibration mode and the display will show the current value and mA representation of the analog output signal. For example,

   Eng: 48.000
   mA: 11.680

   Where **48.000** is the analog output reading representing **11.680** mA. The top line (**Eng**) will alternate between four different readouts: **48.000, UP/DN TO CHANGE, CALIBRATING**, and the parameter label, while the bottom line will always show the mA value.

4. Connect a milliamp meter in series with the loop to measure the current. The field instrument that the loop is driving can also be used to read the output, if desired.

5. Pressing ▪▪will increment the output current to represent 0%, 25%, 50%, 75%, & 100% of the analog output parameter to check the calibration. Pressing ▪▪will decrement the output current. Therefore, 0% = 4mA, 25% = 8mA, 50% = 12mA, 75% = 16mA, & 100% = 20mA.

6. If adjustments are needed, press **zero**. The display now shows:

zero: x.xxx
04.000 +y.yyy mA

Where **x.xxx** represents the default zero value (low scale) and **y.yyy** is the adjustment made to 4mA for the analog output signal. The adjustment can be either positive or negative shown by **+** or **-** respectively. The top line (zero) will alternate between: **x.xxx** and **UP/DN TO ADJUST**. This is the zero-adjusted value to calibrate the analog output to 4mA.

7. Press ▪ or ▪ to increase or decrease the output until the meter reads 4mA or the current zero reference matches the field equipment. Press **ent** to collect the new point.

8. Press **span**. The display shows:

span: x.xxx
20.000 +y.yyy mA

Where **x.xxx** represents the default span value (full scale) and **y.yyy** is the adjustment made to 20mA for the analog output signal. The adjustment can be either positive or negative shown by **+** or **-** respectively. The top line (span) will alternate between: **x.xxx** and **UP/DN TO ADJUST**. This is the span-adjusted value to calibrate the analog output to 20mA.

9. Press ▪ or ▪ to increase or decrease the output until the meter reads 20mA or the current span reference matches the field equipment. Press **ent** to collect the new point.

10. Steps 5 - 9 are required only once. They may be repeated as often as necessary while in calibration, but only the most recent point will be saved on completion of calibration.

11. To permanently store the results of the calibration press **ent**, and the unit will prompt **Enter to accept Calibration**. Simply press **ent** again to save the calibration. Press **esc** to abort the calibration.

ORIFICE RUN APPLICATIONS

(see the section on GROUNDING)

The XARTU/1™ may be adapted to calculate the flow rate in orifice run applications when used with one of the optional differential pressure transmitters. The DP transmitter may be located at the orifice site and wired over to the XARTU/1™, or may be mounted directly to the RTU and tubed over to the run (see Figs. 10 & 11). A second DP may be wired in for dual run applications. In conjunction with static pressure transmitter(s) and temperature probe(s), accurate and corrected flow calculations may be obtained. Eagle Research® has two models of DP transmitters available: The Differential Pressure (DP) and the Multi-Variable Differential Pressure (MVDP). The DP model shown in figures 10a and 10b works in conjunction with a separate external static pressure transmitter mounted in the RTU. The MVDP model shown in figures 11a and 11b has an integral static pressure module, eliminating the need for a separately mounted one.

The unit may be used to measure gas and liquid flow rates with an accuracy of ±0.25% FS including all external effects over a temperature range of -20° F to +140° F. In gas measurement applications the DP and manifold are mounted above the run (as shown in the diagram below). When installed for liquid measurement, the transmitter is mounted below the level of the run. Mounting the RTU is not hindered by the presence of the local DP transmitter, and access to wiring, plumbing, and calibration is very convenient.

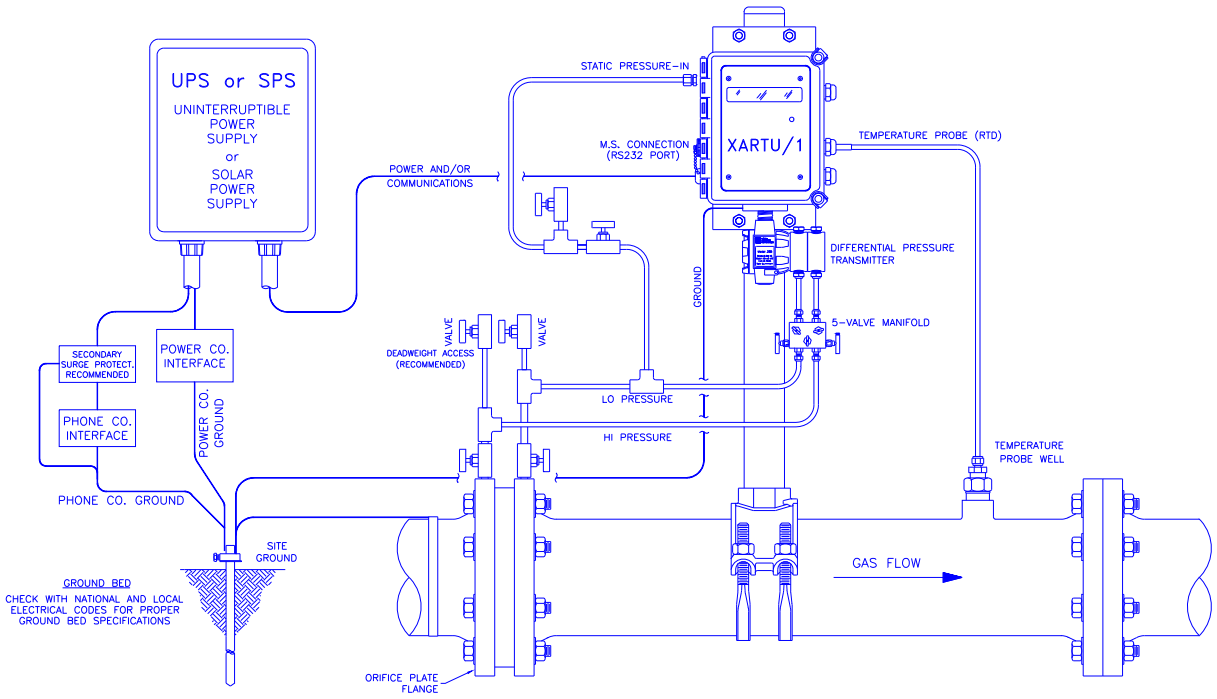


Figure 10a – Typical Orifice Run Application for Gas (DP)
Using the Differential Pressure Transmitter

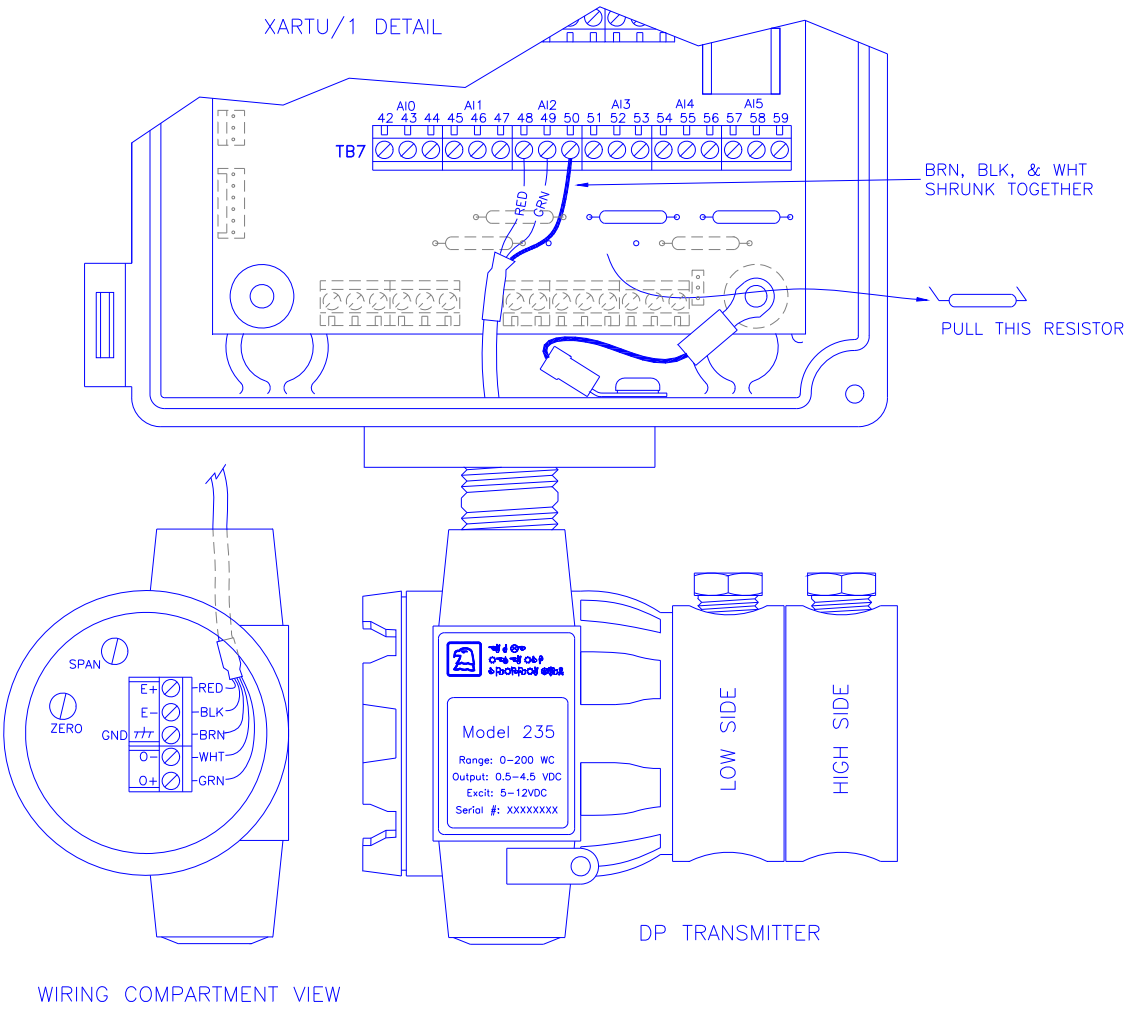


Figure 10b – DP Transmitter Wiring

DP Transmitter Wiring

When field mounting and wiring the DP transmitter, it will typically wire into terminals block TB7, position AI2 (see Fig. 10b). If this is the case, the resistor indicated must be removed as shown by simply unplugging it from the circuit board.

MVDP Transmitter Connection

The MVDP Transmitter has a flat cable extending from the top of the unit, inside the RTU. It passes across the processor board, and plugs into a header at the top edge of its interface board, as shown in Figure 11b.

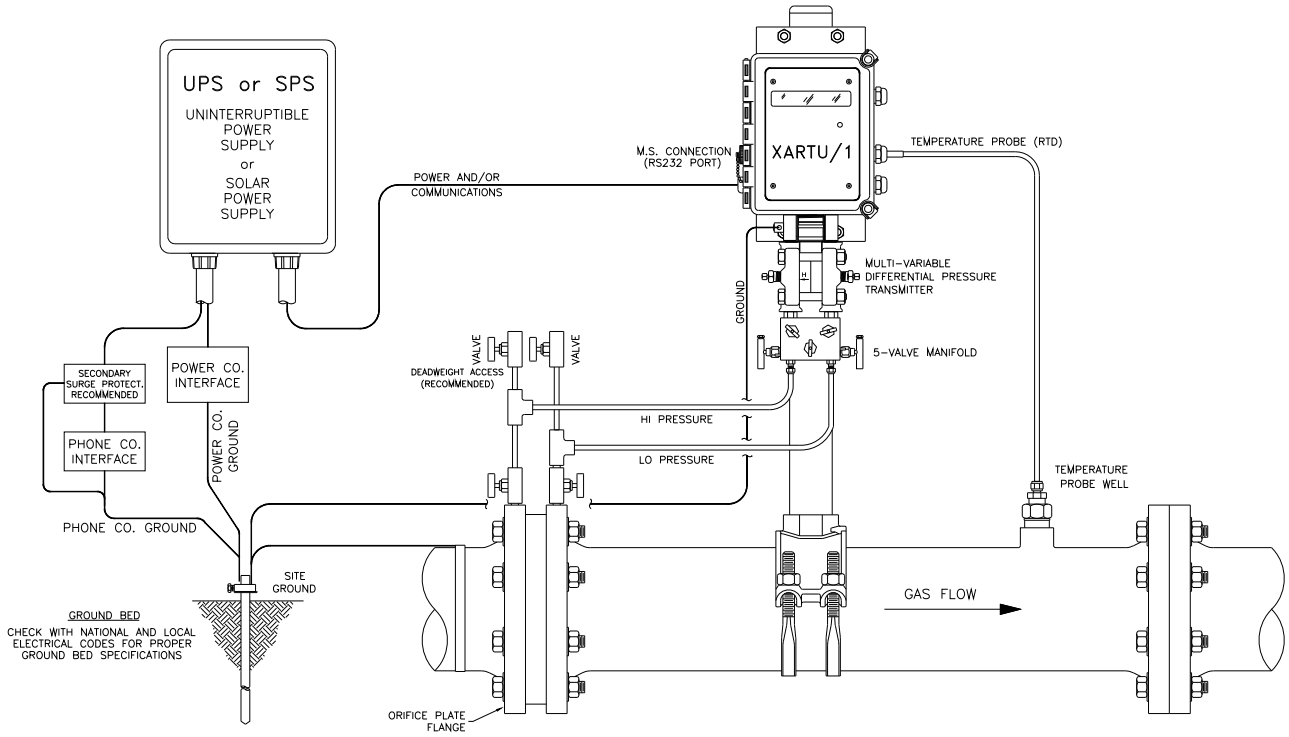


Figure 11a – Typical Orifice Run Application for Gas (MVDP) Using the Multi-Variable Differential Pressure Transmitter

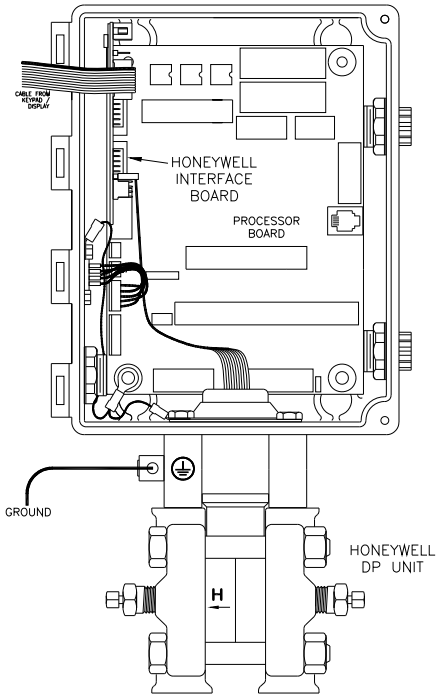


Figure 11b –MVDP Transmitter Connection

MAINTENANCE

As with any device based on solid-state electronics, maintenance of the XARTU/1™ should be minimal. However, there are certain guidelines that, if followed, will minimize device failure and increase the product's service life.

Enclosure Maintenance

Enclosure maintenance is a program of routine inspections to ensure the integrity of the door's seal and the various ports in the box's exterior. Excess moisture can ruin an RTU if allowed to accumulate within the enclosure. Although the circuit boards themselves are conformally coated to protect against humidity, the wiring interconnections and various exposed metal surfaces are susceptible to corrosion in extreme cases of interior humidity. Here are some checks you should periodically make of the enclosure:

1. Ensure that the mounting arrangement for the unit is secure and provides a stable platform for termination of the pressure tubing, conduits, etc.

2. Verify the integrity of the enclosure lid seal. Check the lid gasket for deterioration, chemical damage, tears, or compression.

3. Check for damaged cord grips and a missing or damaged MS connector (RS-232 port) cap.

4. Examine the RS-232C port itself. Ensure that the port's mounting screws are secure and provide firm support when attaching a serial cable.

Changing the Optional Internal Battery

(See the section on POWER FOR THE RTU)

A: Disposable Battery Packs

The disposable (alkaline) battery pack, under normal operating conditions, will eventually drop below the voltage level needed to maintain unit power. Its lifespan is determined by dozens of variables specific to each unit, and therefore difficult to predict.

To replace the disposable battery pack in the unit:

1. Open the front door by releasing the upper and lower quick-release latches on the device enclosure and swinging the door out.

2. Attach the new battery to the unused connector J6 'VBAT1' or J7 'VBAT2' (see Fig. 2).

3. Disconnect the old battery from the other connector in the unit. Power, in this case, is never removed from the unit, and no current data is lost due to temporary power down.

4. Remove the old battery from its mounting in the door, and press the new pack firmly into place.

5. Press any key to wake-up the unit and verify that it is fully operational.

6. Properly dispose of the spent battery pack.

B: Rechargeable Battery Packs (charged by local solar array)

CAUTION
The rechargeable battery pack must ONLY be plugged into the primary battery connector J6 'VBAT1'. The local solar array provides charging current ONLY to connector J6, and to screw terminal 29. Do Not plug rechargeable packs into J7 'VBAT2' as charging will not occur.

The rechargeable battery pack, under normal operating conditions, should provide as many as 10 years of productive service before needing to be replaced. When it becomes apparent that the rechargeable pack cannot maintain its charge during the hours without sunlight, replacement is in order.

To replace the rechargeable battery pack in the unit:

1. Open the front door by releasing the upper and lower quick-release latches on the device enclosure and swinging the door out.
2. Disconnect the old battery from the J6 'VBAT1' connector in the unit. This will result in a momentary power-down of the RTU that will interrupt any measurements being recorded at the time. No historical records or configuration settings will be lost, though.
3. Remove the old battery from its mounting in the door, and press the new pack firmly into place.
4. Connect the new, fully charged battery to the J6 'VBAT1' connector in the unit. DO NOT CONNECT TO J7 (VBAT2)
5. Press any key to wake-up the unit and verify that it is fully operational. A **'first time power'** alarm will have been initiated. See the section on ALARM MODE.

CALIBRATION

Calibration is a crucial element of any program of scheduled maintenance. However, because of the XARTU/1's™ design, software calibration does away with the need for laborious adjustments, thereby simplifying field calibration. See the section on CALIBRATION MODE.

SOFTWARE PACKAGES

TALON™ LITE AND TALON SCE™

The Talon™ software system provides application solutions for Natural Gas, Water/Waster Water, Environmental Protection, Steam, and Electrical applications. Industrial/Commercial Measurement, Pressure/Temperature Monitoring, Supervisory Control, and Odorization are a few of the systems that utilize the software.

Whether your concern is natural gas distribution, gas pipeline transmission or production, Talon gives you the ability to create a powerful system that meets your specific needs. Its flexible design provides the option to purchase only the modules you need, and the ability to expand your system with additional features by adding new modules in the future.

Eagle Research Corporation® designed the Talon™ family specifically to meet your needs, providing software modules for both central office and field operations. A separate manual on the Talon™ Suite of Software is available. Contact your sales representative.

APPENDIX A: PARAMETER TABLES

Each unit built is loaded with a variety of parameters, detailing the way the unit is designed to address a customer's needs. These parameters are defined in Tables, like the example below, and cover such options as Single & Dual Positive Displacement Metering, Single & Dual Orifice Metering, Single & Dual Pressure Monitoring, etc.

The parameter table shown here is **typical** of those associated with each unit manufactured, **and may not accurately represent the configuration at your site.** For further information on the specific configuration for your unit(s), contact your factory representative.

TABLE A-1: PROCESS LISTING **for Single Positive Displacement Metering**

ID	Name	Type
1	System	Extended System
2	Analog Inputs	Extended Analog
3	Press Profile	Ext. 3D Profile
4	Counter Inputs	Counter
5	AGA-7 Meter Run	Turbine (AGA-7)
6	Avg Daily Press	Sum/Avg
7	Avg Daily Temp	Sum/Avg
8	Avg Hourly Press	Sum/Avg
9	Avg Hourly Temp	Sum/Avg
10	Min/Max Press	Min/Max
11	Min/Max Flow	Min/Max
12	Alarm Detector 1	Alarm
13	Alarm Detector 2	Alarm
14	Alarm Detector 3	Alarm
15	Alarm Detector 4	Alarm
16	Alarm Histories	History8
17	Daily Histories	History8
18	Hourly Histories	History8
19	Alarm Dialer	Auto Dialer
20	UnCorr Meter	Turbine (AGA-7)
21	Press Only Meter	Turbine (AGA-7)
22	Analog Output #1	Analog Output
23	Analog Output #2	Analog Output

APPENDIX B: XARTU/1™ CONTROL DRAWING SET

This section contains the six-page set of Control Drawing 9010080 detailing wiring configurations in a Class I, Division 2 hazardous area. The information shown on these sheets must be followed to meet UL certification requirements while operating in this classified area.

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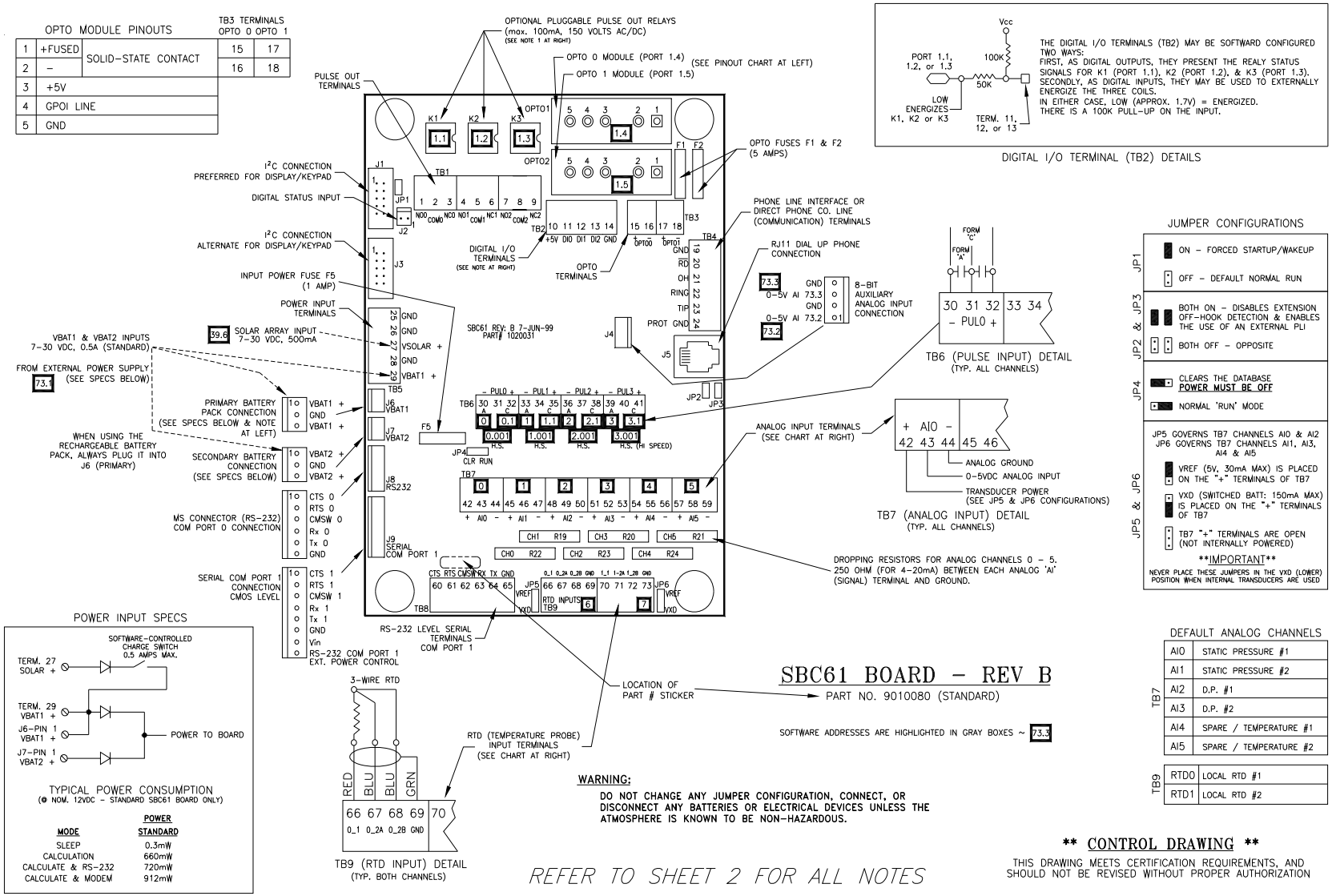
OPTO MODULE PINOUTS
TB3 TERMINALS OPTO 0 OPTO 1
1 +FUSED SOLID-STATE CONTACT 15 17
2 – 16 18
3 +5V
4 GPOI LINE
5 GND
OPTIONAL PLUGGABLE PULSE OUT RELAYS (max. 100mA, 150 VOLTS AC/DC) (SEE NOTE 1 AT RIGHT)
OPTO 0 MODULE (PORT 1.4) (SEE PINOUT CHART AT LEFT)
OPTO 1 MODULE (PORT 1.5)
PULSE OUT TERMINALS
OPTO FUSES F1 & F2 (5 AMPS)
I²C CONNECTION PREFERRED FOR DISPLAY/KEYPAD
DIGITAL STATUS INPUT
I²C CONNECTION ALTERNATE FOR DISPLAY/KEYPAD
INPUT POWER FUSE F5 (1 AMP)
POWER INPUT TERMINALS
VBAT1 & VBAT2 INPUTS 7-30 VDC, 0.5A (STANDARD)
FROM EXTERNAL POWER SUPPLY (SEE SPECS BELOW)
73.1
39.6 SOLAR ARRAY INPUT 7-30 VDC, 500mA
PRIMARY BATTERY PACK CONNECTION (SEE SPECS BELOW & NOTE AT LEFT)
WHEN USING THE RECHARGEABLE BATTERY PACK, ALWAYS PLUG IT INTO J6 (PRIMARY)
SECONDARY BATTERY CONNECTION (SEE SPECS BELOW)
MS CONNECTOR (RS-232) COM PORT 0 CONNECTION
SERIAL COM PORT 1 CONNECTION CMOS LEVEL
DIGITAL I/O TERMINALS (SEE NOTE AT RIGHT)
OPTO TERMINALS
PHONE LINE INTERFACE OR DIRECT PHONE CO. LINE (COMMUNICATION) TERMINALS
RJ11 DIAL UP PHONE CONNECTION
8-BIT AUXILIARY ANALOG INPUT CONNECTION
0-5V AI 73.3
0-5V AI 73.2
SBC61 REV: B 7-JUN-99 PART# 1020031
CLR RUN
ANALOG INPUT TERMINALS (SEE CHART AT RIGHT)
ANALOG GROUND
0-5VDC ANALOG INPUT
TRANSDUCER POWER (SEE JP5 & JP6 CONFIGURATIONS)
TB7 (ANALOG INPUT) DETAIL (TYP. ALL CHANNELS)
TB6 (PULSE INPUT) DETAIL (TYP. ALL CHANNELS)
DROPPING RESISTORS FOR ANALOG CHANNELS 0 – 5. 250 OHM (FOR 4-20mA) BETWEEN EACH ANALOG 'AI' (SIGNAL) TERMINAL AND GROUND.
RS-232 LEVEL SERIAL TERMINALS COM PORT 1
LOCATION OF PART # STICKER
SBC61 BOARD – REV B
PART NO. 9010080 (STANDARD)
SOFTWARE ADDRESSES ARE HIGHLIGHTED IN GRAY BOXES ~ 73.3
3-WIRE RTD
RTD (TEMPERATURE PROBE) INPUT TERMINALS (SEE CHART AT RIGHT)
TB9 (RTD INPUT) DETAIL (TYP. BOTH CHANNELS)
DIGITAL I/O TERMINAL (TB2) DETAILS
THE DIGITAL I/O TERMINALS (TB2) MAY BE SOFTWARD CONFIGURED TWO WAYS:
FIRST, AS DIGITAL OUTPUTS, THEY PRESENT THE REALY STATUS SIGNALS FOR K1 (PORT 1.1), K2 (PORT 1.2), & K3 (PORT 1.3).
SECONDLY, AS DIGITAL INPUTS, THEY MAY BE USED TO EXTERNALLY ENERGIZE THE THREE COILS.
IN EITHER CASE, LOW (APPROX. 1.7V) = ENERGIZED.
THERE IS A 100K PULL-UP ON THE INPUT.
JUMPER CONFIGURATIONS
JP1 ON – FORCED STARTUP/WAKEUP
OFF – DEFAULT NORMAL RUN
JP2 & JP3 BOTH ON – DISABLES EXTENSION OFF-HOOK DETECTION & ENABLES THE USE OF AN EXTERNAL PLI
BOTH OFF – OPPOSITE
JP4 CLEARS THE DATABASE POWER MUST BE OFF
NORMAL 'RUN' MODE
JP5 & JP6 JP5 GOVERNS TB7 CHANNELS AI0 & AI2 JP6 GOVERNS TB7 CHANNELS AI1, AI3, AI4 & AI5
VREF (5V, 30mA MAX) IS PLACED ON THE "+" TERMINALS OF TB7
VXD (SWITCHED BATT; 150mA MAX) IS PLACED ON THE "+" TERMINALS OF TB7
TB7 "+" TERMINALS ARE OPEN (NOT INTERNALLY POWERED)
IMPORTANT
NEVER PLACE THESE JUMPERS IN THE VXD (LOWER) POSITION WHEN INTERNAL TRANSDUCERS ARE USED
POWER INPUT SPECS
SOFTWARE-CONTROLLED CHARGE SWITCH 0.5 AMPS MAX.
TERM. 27 SOLAR +
TERM. 29 VBAT1 +
J6-PIN 1 VBAT1 +
J7-PIN 1 VBAT2 +
POWER TO BOARD
TYPICAL POWER CONSUMPTION
(@ NOM. 12VDC – STANDARD SBC61 BOARD ONLY)
MODE POWER STANDARD
SLEEP 0.3mW
CALCULATION 660mW
CALCULATE & RS-232 720mW
CALCULATE & MODEM 912mW
DEFAULT ANALOG CHANNELS
TB7 AI0 STATIC PRESSURE #1
AI1 STATIC PRESSURE #2
AI2 D.P. #1
AI3 D.P. #2
AI4 SPARE / TEMPERATURE #1
AI5 SPARE / TEMPERATURE #2
TB9 RTD0 LOCAL RTD #1
RTD1 LOCAL RTD #2
WARNING:
DO NOT CHANGE ANY JUMPER CONFIGURATION, CONNECT, OR DISCONNECT ANY BATTERIES OR ELECTRICAL DEVICES UNLESS THE ATMOSPHERE IS KNOWN TO BE NON-HAZARDOUS.
REFER TO SHEET 2 FOR ALL NOTES
** CONTROL DRAWING **
THIS DRAWING MEETS CERTIFICATION REQUIREMENTS, AND SHOULD NOT BE REVISED WITHOUT PROPER AUTHORIZATION

** CONTROL DRAWING **

THIS DRAWING MEETS CERTIFICATION REQUIREMENTS, AND SHOULD NOT BE REVISED WITHOUT PROPER AUTHORIZATION

WARNING – EXPLOSION HAZARD:

- SUBSTITUTION OF COMPONENTS MAY IMPAIR SUITABLILTY FOR CLASS 1, DIV. 2 USE.
- DO NOT REPLACE BATTERIES UNLESS POWER HAS BEEN SWITCHED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.
- DO NOT CONNECT OR DISCONNET EQUIPMENT UNLESS POWER HAS BEEN SWITHCED OFF OR THE AREA IS KNOWN TO BE NON-HAZARDOUS.

NOTES:

1) ALL WIRE CONNECTIONS SHOULD BE MADE USING CLASS I, DIV. 2 WIRING METHODS. IF ANY DEVICE IS PHYSICALLY LOCATED WITHIN THE HAZARDOUS AREA, IT MUST BE APPROVED FOR CLASS I, DIV. 2. (SEE NOTE 3)

2) ALL WIRING AND GROUNDING MUST BE INSTALLED ACCORDING TO LOCAL, STATE, AND FEDERAL CODES FOR INSTALLATION IN A CLASS I, DIV. 2 AREA. REFER TO NFPA 70, NATIONAL ELECTRICAL CODE SECTION 501-4(b).

3) INPUTS MAY RANGE FROM 12-140VAC/VDC AND OUTPUTS FROM 5-60VDC @ 3A, 5-200VDC @ 1A, & 12-140VDC @ 3A DEPENDING ON THE MODULES INSTALLED. CUSTOMER DEVICES MUST NOT EXCEED THE RATINGS OF THE INSTALLED MODULES.

4) PHONE INTERFACE LOGIC LINES:
RD=RING DETECT. A LOGIC LEVEL INPUT TO THE RTU WHICH RESTS HIGH (+5VDC) AND GOES LOW (0 VDC) ON RING DETECT.
OH=OFF HOOK. A LOGIC LEVEL OUTPUT FROM THE RTU WHICH RESTS LOW AND GOES HIGH WHEN THE RTU COMMANDS A PHONE LINE INTERFACE RESPONSE.
'TIP' & 'RING' ARE THE DIAL-UP PHONE LINE CONNECTIONS, OR THE TONE SIGNAL FRON THE PHONE LINE INTERFACE.

5) ALL +5V TERMINALS, AND THE PULSER "+" TERMINALS, ARE CURRENT-LIMITED 5VDC THROUGH A 1K OHM SERIES RESISTOR.

6) THE ANALOG INPUT'S '+' TERMINALS MAY BE JUMPER CONFIGURED TO INTERNALLY PROVIDE Vref OR VXD, OR MAY BE LEFT OPEN AS A BUSS FOR APPLYING EXTERNAL POWER. JUMPER JP5 APPLIES THIS FEATURE TO CHANNELS AI0 AND AI2. JUMPER JP6 APPLIES IT TO AI1, AI3, AI4, AND AI5. SEE DRAWING 9010080 SHEET 1 FOR JP5 & JP6 POSITION DETAILS.

7) ALL "+" TERMINALS ON THE 'PULSE INPUT' SECTION ARE CURRENT-LIMITED 5VDC THROUGH A 1K OHM SERIES RESISTOR. LIKEWISE, ALL PULSE INPUT "-" TERMINALS ARE CURRENT-LIMITED GROUND THROUGH A 1K OHM SERIES RESISTOR.

8) WHEN A RECHARGEABLE (LEAD ACID) BATTERY PACK IS USED, IT MUST BE PLUGGED INTO J6 (PRIMARY). **ONLY** ONE TYPE OF BATTERY PACK SHOULD BE USED IN A GIVEN UNIT. MIXING DIFFERENT BATTERY PACK TYPES IN A SINGLE UNIT MAY BE HAZARDOUS.

ONLY THE FOLLOWING BATTERY PACKS ARE APPROVED FOR USE:

QUAD-D SEALED LEAD RECHARGEABLE	PN 2040012	8V, 2.5Ah
EIGHT-C ALKALINE PACK	PN 2040013	12V, 7.8Ah
SIX-D SEALED LEAD RECHARGEABLE	PN 2040014	12V, 2.5Ah
QUAD-D LITHIUM PACK	PN 2040015	14.4V, 16.5Ah
ALTERNATE – ANY UL R/C (BAZR2) BATTERY w/12V, UP TO 17Ah MAX.		

9) FOR ALL APPLICABLE COMMUNICATIONS CIRCUITS WITH 'CMSW', A CLOSED SWITCH ACTIVATES THE COMMINICATION FEATURE IN THE RTU.

10) THE FOLLOWING MODULES ARE APPROVED FOR USE WITH THE DIGITAL I/O BOARD (#9010113):
MAY BE POPULATED WITH ANY R/C (NRNT2) INDUSTRIAL CONTROL SWITCH TYPE OAC5 MAX. RATED 2.0A, 140 VAC ~ OR ODC5, RATED 2.5A, 60 VDC, MANUFACTURED BY GRAYHILL ~ OR IAC5 RATED 9.0 mA, 140 VAC, 5 VDC MIN "LOGIC LEVEL" OUTPUT ~ OR IDC5 RATED 30mA, 32 VDC, 5 VDC MIN "LOGIC LEVEL" OUTPUT.

11) WHEN USING ALTERNATE CONSTRUCTION WITH IRIDIUM WINI BOARD (#9010352) THE INPUT POWER RATING IS 7-15.2VDC, 1.0A MAX.

12) IF OPTO MODULE OR BATTERY TEMPERATURE RATING IS LESS THAN RTU RATING, THEN RTU RATING SHALL BE DERATED TO THE SMALLER OF THE TWO. EXAMPLE: GRAYHILL 70-ODC5 IS RATED AT 40 DEGREES CELSIUS AND INSTALLED IN A 70 DEGREES CELSIUS RATED RTU; THE NEW RTU RATING SHALL BE 40 DEGREES CELSIUS.

13) OPTIONAL: APPROVED TERMINAL BLOCK (6E/DS MFG: WIELAND) MAY BE USED FOR FIELD WIRING

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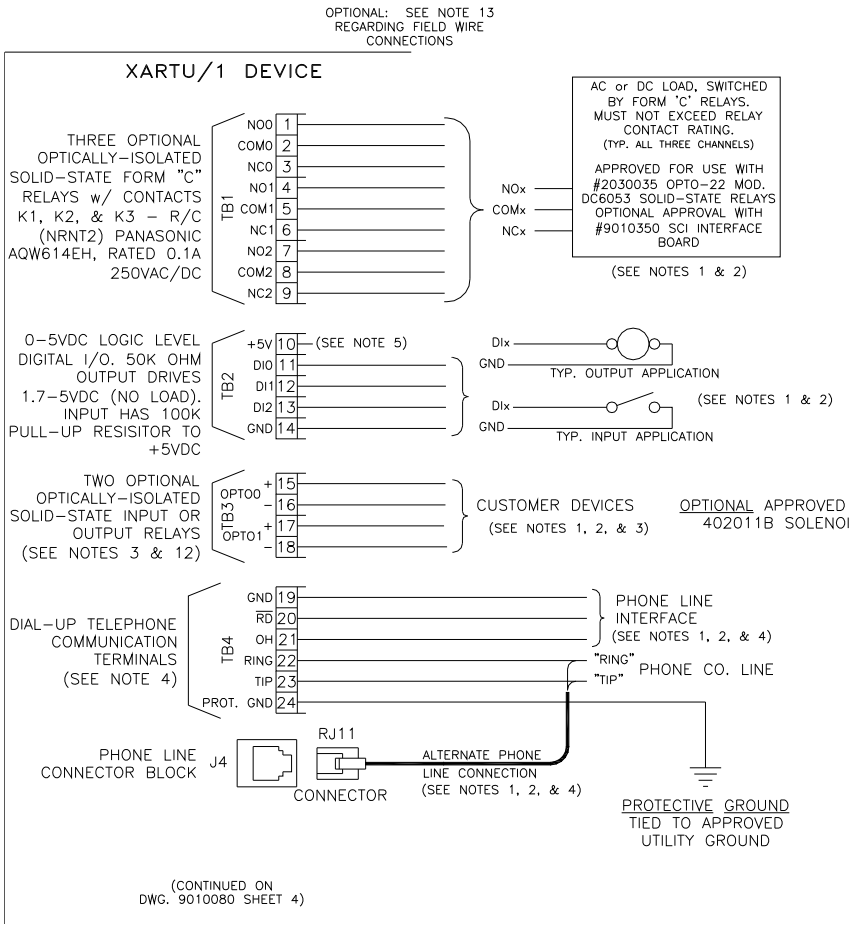
CLASS I, DIV. 2, GROUPS A–D AREA INSTALLATION



** CONTROL DRAWING **

THIS DRAWING MEETS CERTIFICATION REQUIREMENTS, AND SHOULD NOT BE REVISED WITHOUT PROPER AUTHORIZATION

WARNING:

DO NOT CHANGE ANY JUMPER CONFIGURATION, CONNECT, OR DISCONNECT ANY BATTERIES OR ELECTRICAL DEVICES UNLESS THE ATMOSPHERE IS KNOWN TO BE NON–HAZARDOUS.

NOTES:

REFER TO SHEET 2 FOR ALL REFERENCED NOTES.

OPTIONAL APPROVED P/N:
402011B SOLENOID, 12V, LATCHING, 3–WAY

OPTIONAL APPROVED P/N:
9010115 SPM BOARD w/TWO 200V CHANNELS
9010075 SPM BOARD w/SIX 35V CHANNELS
9010150 SPM BOARD w/SIX 35V CHANNELS (INPUT TERMINALS)
9010341 SPM BOARD w/SIX 35V CHANNELS (PLUGGABLE TERMINAL BLOCKS)

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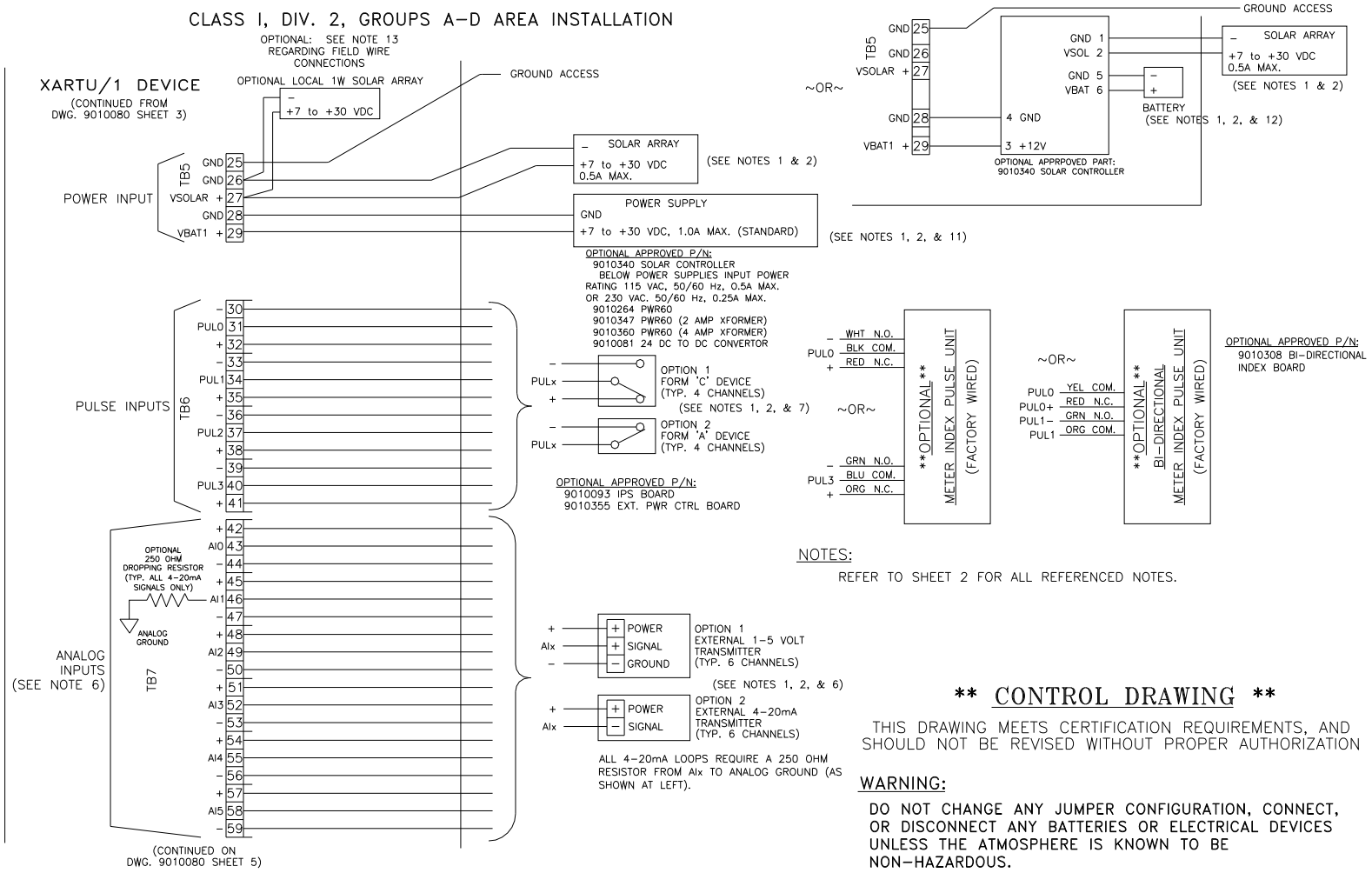

NOTES:

REFER TO SHEET 2 FOR ALL REFERENCED NOTES.

** CONTROL DRAWING **

THIS DRAWING MEETS CERTIFICATION REQUIREMENTS, AND SHOULD NOT BE REVISED WITHOUT PROPER AUTHORIZATION

WARNING:

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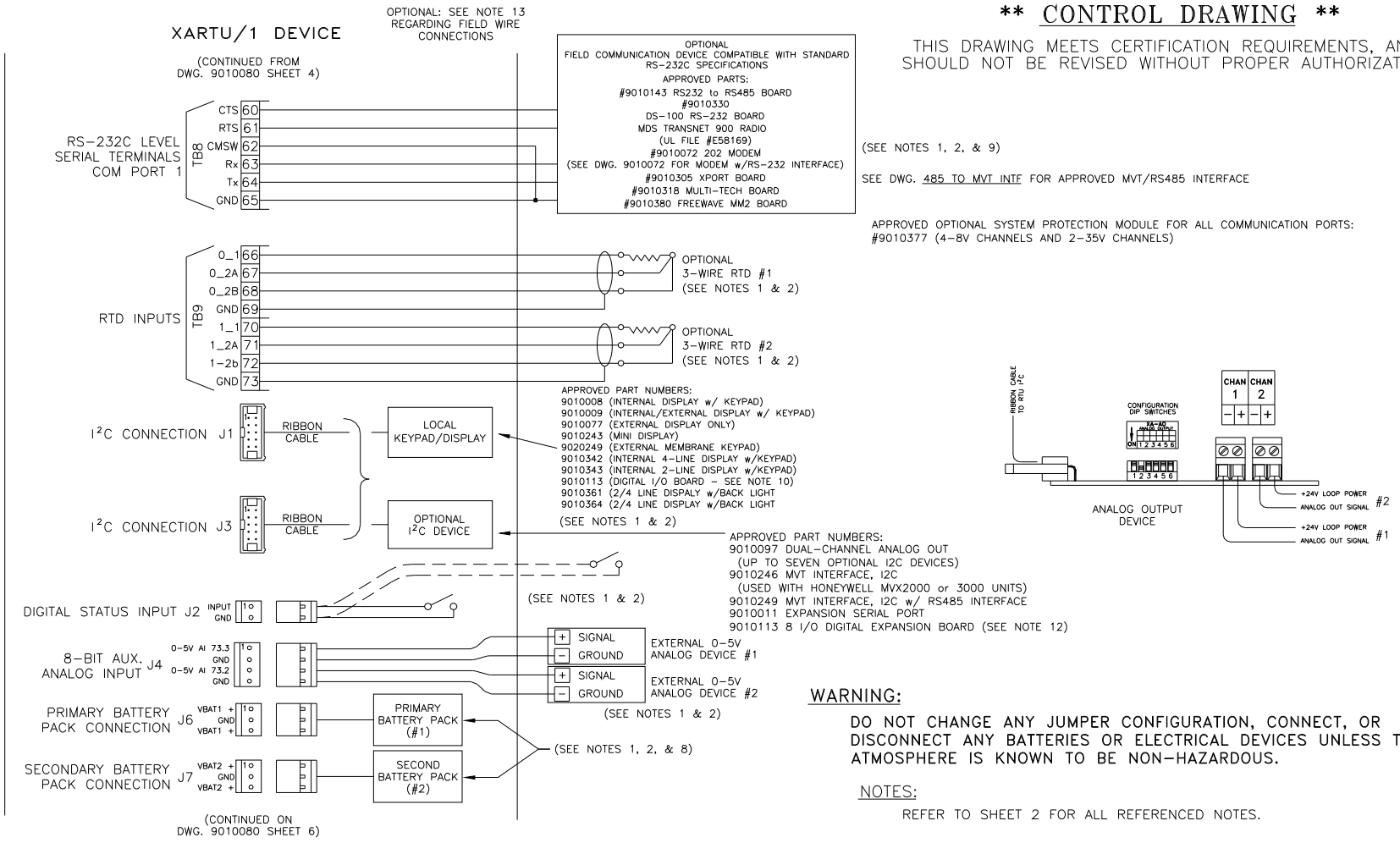
** CONTROL DRAWING **

THIS DRAWING MEETS CERTIFICATION REQUIREMENTS, AND SHOULD NOT BE REVISED WITHOUT PROPER AUTHORIZATION



WARNING:

DO NOT CHANGE ANY JUMPER CONFIGURATION, CONNECT, OR DISCONNECT ANY BATTERIES OR ELECTRICAL DEVICES UNLESS THE ATMOSPHERE IS KNOWN TO BE NON-HAZARDOUS.

NOTES:

REFER TO SHEET 2 FOR ALL REFERENCED NOTES.

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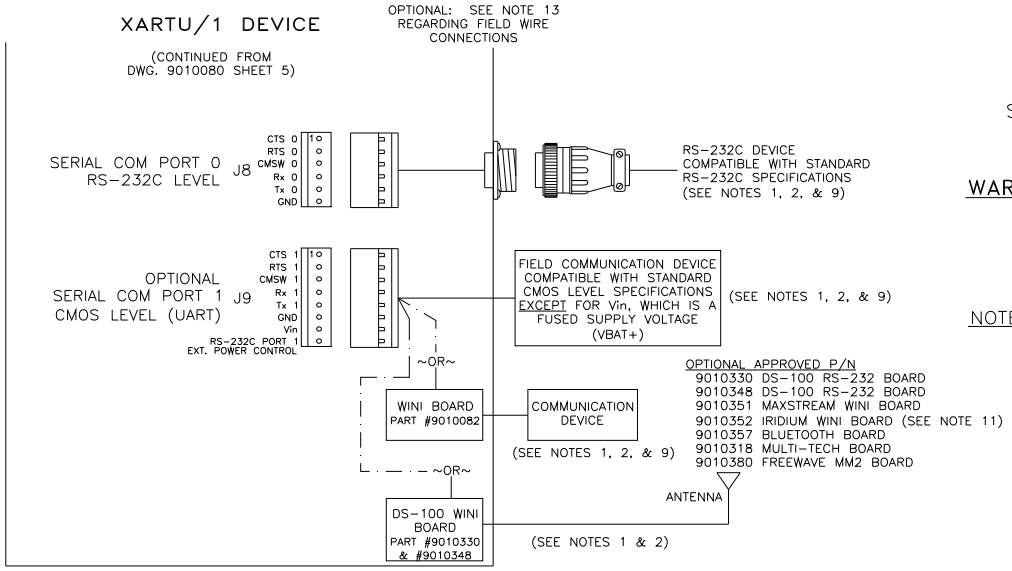
CLASS I, DIV. 2, GROUPS A–D AREA INSTALLATION


XARTU/1 DEVICE
(CONTINUED FROM DWG. 9010080 SHEET 5)
OPTIONAL: SEE NOTE 13 REGARDING FIELD WIRE CONNECTIONS
SERIAL COM PORT 0 RS-232C LEVEL
J8
CTS 0
RTS 0
CMSW 0
Rx 0
Tx 0
GND
RS-232C DEVICE COMPATIBLE WITH STANDARD RS-232C SPECIFICATIONS (SEE NOTES 1, 2, & 9)
OPTIONAL SERIAL COM PORT 1 CMOS LEVEL (UART)
J9
CTS 1
RTS 1
CMSW 1
Rx 1
Tx 1
GND
Vin
RS-232C PORT 1 EXT. POWER CONTROL
FIELD COMMUNICATION DEVICE COMPATIBLE WITH STANDARD CMOS LEVEL SPECIFICATIONS EXCEPT FOR Vin, WHICH IS A FUSED SUPPLY VOLTAGE (VBAT+)
(SEE NOTES 1, 2, & 9)
~OR~
WINI BOARD PART #9010082
COMMUNICATION DEVICE
(SEE NOTES 1, 2, & 9)
OPTIONAL APPROVED P/N
9010330 DS-100 RS-232 BOARD
9010348 DS-100 RS-232 BOARD
9010351 MAXSTREAM WINI BOARD
9010352 IRIDIUM WINI BOARD (SEE NOTE 11)
9010357 BLUETOOTH BOARD
9010318 MULTI-TECH BOARD
9010380 FREEWAVE MM2 BOARD
~OR~
ANTENNA
DS-100 WINI BOARD PART #9010330 & #9010348
(SEE NOTES 1 & 2)

** CONTROL DRAWING **

THIS DRAWING MEETS CERTIFICATION REQUIREMENTS, AND SHOULD NOT BE REVISED WITHOUT PROPER AUTHORIZATION

WARNING:

DO NOT CHANGE ANY JUMPER CONFIGURATION, CONNECT, OR DISCONNECT ANY BATTERIES OR ELECTRICAL DEVICES UNLESS THE ATMOSPHERE IS KNOWN TO BE NON-HAZARDOUS.

NOTES:

REFER TO SHEET 2 FOR ALL REFERENCED NOTES.

APPENDIX C: POSITIVE DISPLACEMENT APPLICATIONS

(see the section on GROUNDING)

INTRODUCTION

The XARTU/1™ may be adapted to calculate flow based on pulses received from the optional index assembly installed on a meter drive. The index assembly may be mounted directly to the RTU, or may be located on the meter drive and wired over to the XARTU/1™. Magnetically operated reed switches inside the index assembly send electronic pulses as the drive turns. These pulses represent uncorrected meter volume to the XARTU/1™. With the integral static pressure transmitter(s) and temperature probe(s), accurate flow calculations may be obtained.

To eliminate false counts that can result from reed switch "bounce", the XARTU/1™ uses a set/reset, dual-reed switch configuration. An input pulse is generated only when the opening and closing of the first switch is followed by the opening and closing of the second switch.

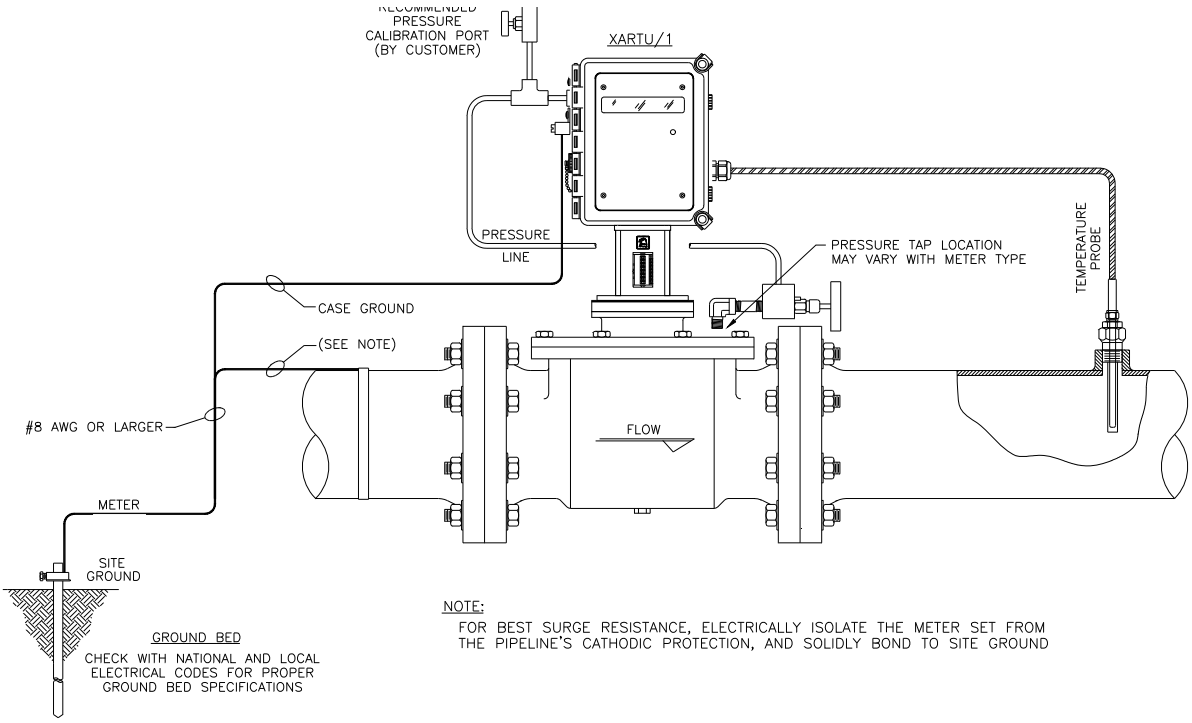


Figure 12 - Typical Positive Displacement Application for Gas

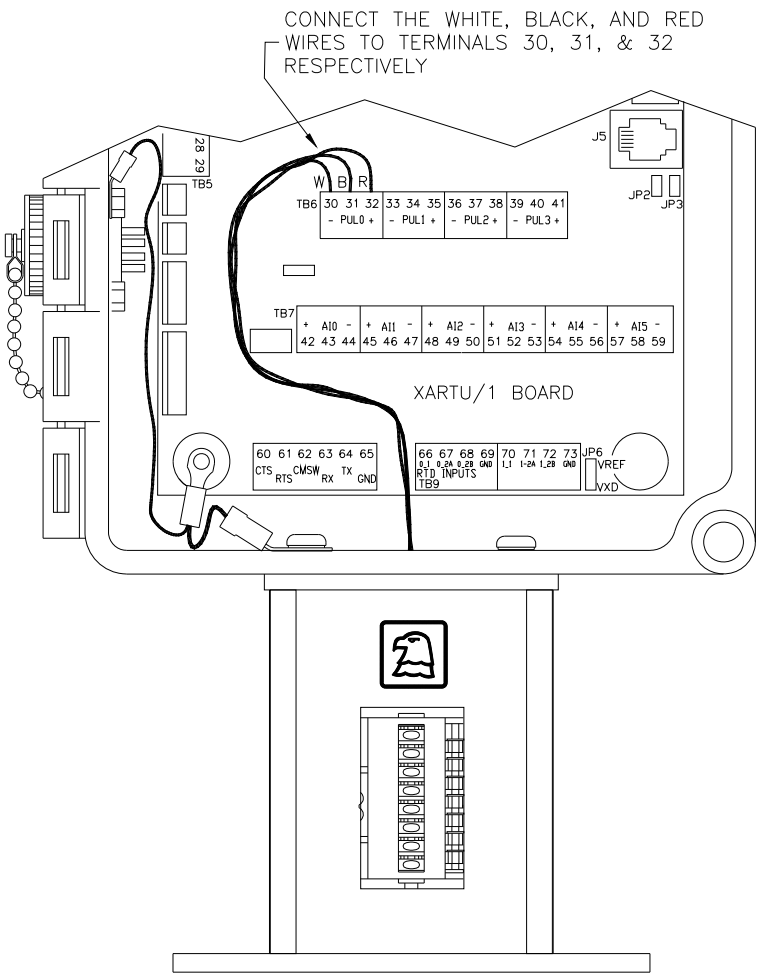

CONNECT THE WHITE, BLACK, AND RED WIRES TO TERMINALS 30, 31, & 32 RESPECTIVELY
W B R
TB6 30 31 32 - PUL0 + 33 34 35 - PUL1 + 36 37 38 - PUL2 + 39 40 41 - PUL3 +
TB7 + AI0 - 42 43 44 + AI1 - 45 46 47 + AI2 - 48 49 50 + AI3 - 51 52 53 + AI4 - 54 55 56 + AI5 - 57 58 59
XARTU/1 BOARD
60 61 62 63 64 65 CTS RTS CMSW RX TX GND
66 67 68 69 70 71 72 73 RTD INPUTS TB9
JP6 VREF VXD
J5
JP2 JP3
TB5 28 29

Figure 13 - Index Assembly Wiring

INDEX ASSEMBLY WIRING

The index assembly will typically wire into terminal block TB6, (position 30 *Set*, 31 *Pulse*, 32 *Reset*) as shown in Figure 13.

The pulse input is software selectable for Form-C (3-wire, Low Speed), Form-A (2-wire, Low Speed) or Form-A (2-wire, High Speed) configuration. Talon Device Manager or SCADA software can be used to configure the pulse input. The optional keypad / display can also be used to configure the pulse input and other parameters.

OPTIONAL UNCORRECTED MECHANICAL PULSE OUTPUT

An optional uncorrected mechanical pulse output can be provided with the standard vertical index (see Figure 14). This uncorrected pulse output is derived from two additional Form 'A' reed switches in the index assembly. As the magnet in the drive's assembly rotates past these switches, a single uncorrected volume pulse is generated. As with the standard index, volume per pulse is determined by the drive rate. Each uncorrected volume pulse is equal to the gas flow for one shaft revolution.

The pulse output can be wired as two Form 'A' outputs or one Form 'C ' output. To wire as Form 'A', use the first two terminals (white and black wires) for one output, and the second and third terminals (black and red), for a second output as necessary. For Form 'C' applications, wire in to all three terminals, using the center (black wire) terminal as common.

The duration (width) of each pulse is equal to the length of time the reed switch is in its closed position (depends on the rate of the meter). No configuration is necessary to enable the uncorrected pulse output.

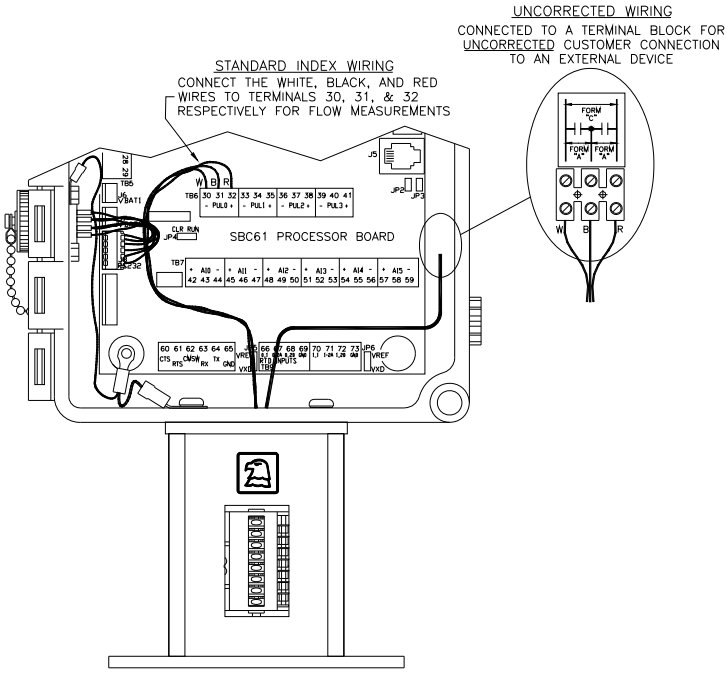

UNCORRECTED WIRING
CONNECTED TO A TERMINAL BLOCK FOR UNCORRECTED CUSTOMER CONNECTION TO AN EXTERNAL DEVICE
STANDARD INDEX WIRING
CONNECT THE WHITE, BLACK, AND RED WIRES TO TERMINALS 30, 31, & 32 RESPECTIVELY FOR FLOW MEASUREMENTS
SBC61 PROCESSOR BOARD
FORM 'C'
FORM 'A'
FORM 'A'
W
B
R

Figure 14 – Uncorrected Pulse Wiring

MOUNTING THE XARTU/1™ ON THE METER

The index assembly permits installation of the XARTU/1™ on a wide variety of meters. In general, the front of the XARTU/1™ should face the front of the meter. In certain applications, the XARTU/1™ can be installed 180° from the standard position by removing all four (4) screws that attach the index base plate to the index housing. Replace the screws after you have repositioned the unit.

A reversible counter assembly permits the index to be used on either clockwise (CW) or counterclockwise (CCW) rotating meters. Perform the following checks before installing the unit:

1. Check the meter drive rotation by looking down on the meter-driving dog. Note whether it rotates clockwise (CW) or counterclockwise (CCW).

2. The standard index is setup for clockwise (CW) meter drives. The rotation of the unit can be changed for counterclockwise (CCW) meter drives. See Fig. 14 - Reversing the Index Rotation.

3. Determine the desired reading for the mechanical index and mask the index assembly. See Table C-1, and Fig. 15 - Counter Masking, on the following pages.

4. Align the index base plate holes with the corresponding holes in the top of the meter. Secure the unit by bolting it to the meter. Ensure that the drive dog and index wriggler are correctly aligned and not binding.

5. Plug all unused holes in the index base plate with the rubber plugs provided.

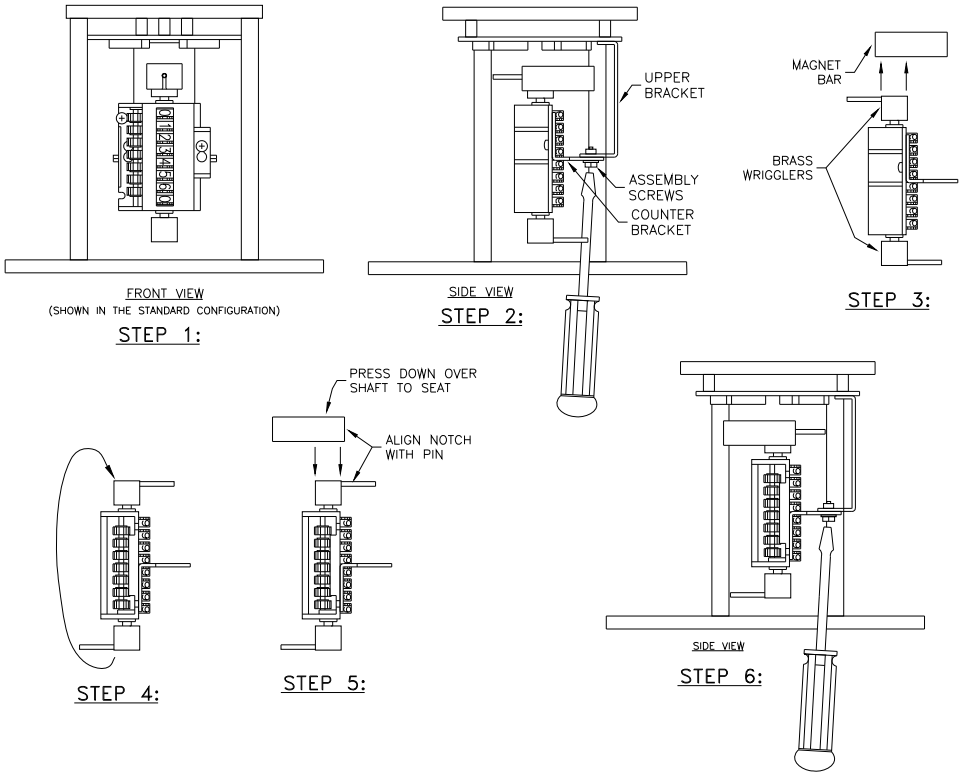


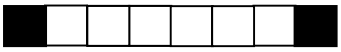
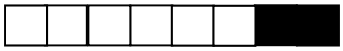
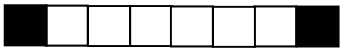
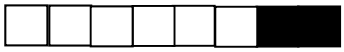
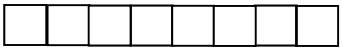
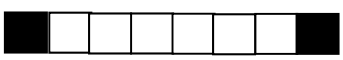
Figure 15 – Reversing the Index Rotation

REVERSING THE INDEX ROTATION

The default configuration of the counter is as shown in Step 1 of Figure 14; with the most significant digit at the top, and the least at the bottom. This would be used on meters having clockwise (CW) rotation. For meters having counterclockwise rotation, the counter assembly must be reversed as follows:

1. The unit is shown in its standard configuration – set up for a clockwise rotating meter.
2. Remove the two-hex/slotted screws holding the counter bracket to the upper bracket, and remove the counter assembly.
3. Remove the magnet bar from the counter by gently pulling it away from the brass wriggler. Be careful not to flex the pliable bar assembly or plastic counter body more than necessary.
4. Flip the entire counter assembly end for end.
5. Press the magnet bar firmly onto the opposite brass wriggler, aligning its notch with the wriggler's roll pin. As before, take care not to stress the bar or counter any more than necessary. Make sure the magnet bar is firmly and squarely seated on the wriggler body.
6. Reinstall the counter assembly into the index housing in the reverse order it was removed. Being careful not to twist the upper bracket, snug down the two assembly screws. Make sure the counter turns freely before mounting onto the meter.

TABLE C-1: 8-DIGIT COUNTER MASKING

Drive (Ft^3/Rev)	Index Reading Multiplier	Counter Masking
10	DCF	
	CCF	
	MCF	
100	CCF	
	MCF	
1,000	CCF	
	MCF	

Index Reading Multiplier:
DCF = Reading times ten feet CCF = reading times one hundred feet MCF = reading times one thousand feet

Counter Masking

In the configuration shown in Figure 15, the index counter is positioned so the digits read from top to bottom (clockwise meter rotation as viewed from top). In this case, the desired mask can be used to hide those digits not needed from either end of the readout. Refer also to Table C-1.

1. Wipe any accumulated dust from the face of the counter with alcohol and allow it to dry.

2. Peel the backing from the chosen mask and apply. Note that the mask and the counter face both have a wider area above the readout, and a narrower one below.

3. Peel the backing from the cubic feet or meters per **revolution** label and place in the wide area above the readout.

4. Peel the backing from the cubic foot **resolution** label and place in the narrow area below the readout.

Note: In cases where the counter is reversed (for meters having counterclockwise rotation), the entire procedure is flipped 180°.

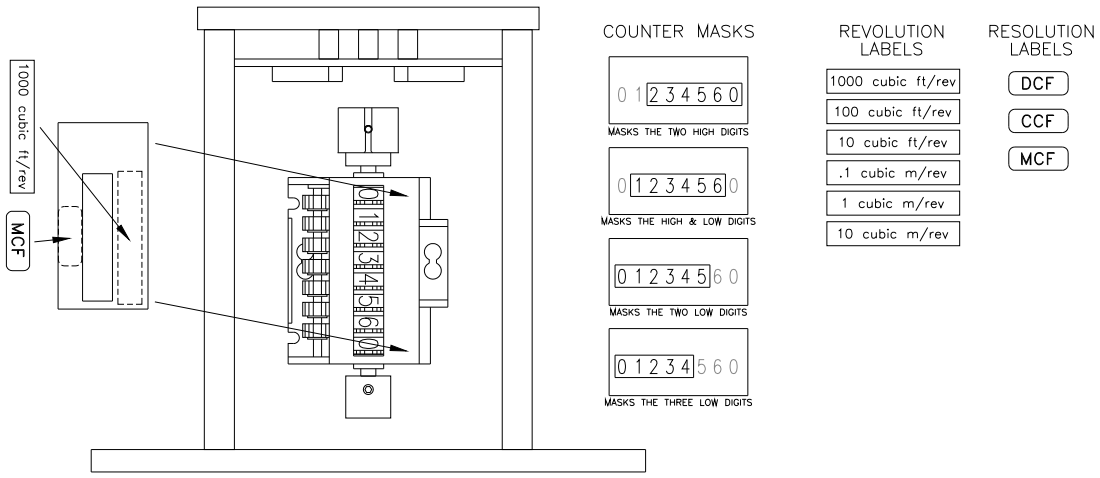


Figure 16 – Counter Masking Kit Application

APPENDIX D: SATELLITE COMMUNICATIONS APPLICATIONS

Optional I9602 WINI

The optional I6602 WINI board and module may be added to the XARTU/1™ to allow satellite communications from the Remote Unit to the home office. This board provides controlled power to the SBD9602 Iridium Radio. It also has a built in temperature-compensated 70-WATT solar charger, and is a distribution point for 12VDC. This board provides CMOS and RS232 communications interface to the 9602 transceiver module.

EEPROM and Database Setting Requirements for Iridium Communications

XARTU/1 with the Iridium 9602 CMOS version connected on Port 1:

Location	Description	Value	Notes
14	com1_cfg_bits1	0	
15	com1_cfg_bits2	0	
16	com1_CMOS Enable 1		CMOS COMM ON
17	com1 Main Baud	19200	19200 baud for the Iridium 9602 Radio
26	com1 Power Addr	39.5	Set up for power control
75	sys_config1	16	Auto Daylight Savings Time ON This setting is normally used to allow daylight savings mode to be used when setting the rtu time from the Orbcomm radio.

XARTU/1 with the Iridium 9602 RS232 version connected on Port 1:

Location	Description	Value	Notes
14	com1_cfg_bits1	0	
15	com1_cfg_bits2	16	Ignore CMSW
16	com1_CMOS Enable	0	
17	com1 Main Baud	19200	19200 baud for the Iridium 9602 Radio
26	com1 Power Addr	59.7	Set up for power control using the CMSW1 line on the SBC61
75	sys_config1	16	Auto Daylight Savings Time ON. This setting is normally used to allow daylight savings mode to be used when setting the rtu time from the Orbcomm radio.

Important Process Items that must be set when using the Iridium 9602 (CMOS and RS232 Versions)

In the Extended System Process:

PP-SS-II	Description	Value	Notes
1-05-16	Comm Keep Awake Secs	60	
1-06-04	Allow Sleep	0	The XARTU stays awake while sending Iridium messages.
1-06-07	Min Voltage for Wake	11.5	

In the Master SatCom Process:

PP-SS-II	Description	Value	Notes
PP-04-07	SatComm Radio Type	20	20 Selects Iridium 9602
PP-04-14	Time Adj Threshold	60	Recommended
PP-05-15	Low Voltage Reset	12.5	
PP-05-16	Low Voltage Limit	11.5	
PP-06-12	Random Delay Seconds	600	This specifies the number of seconds for the required Random delay window before sending out periodic Iridium messages. It doesn't apply to alarm messages.
PP-06-16	SatComm Options	2	This value must be set to 2 to enable event log messages. It should be set to 0 if event messages are not desired. There are no special requirements in slave SatComm processes.

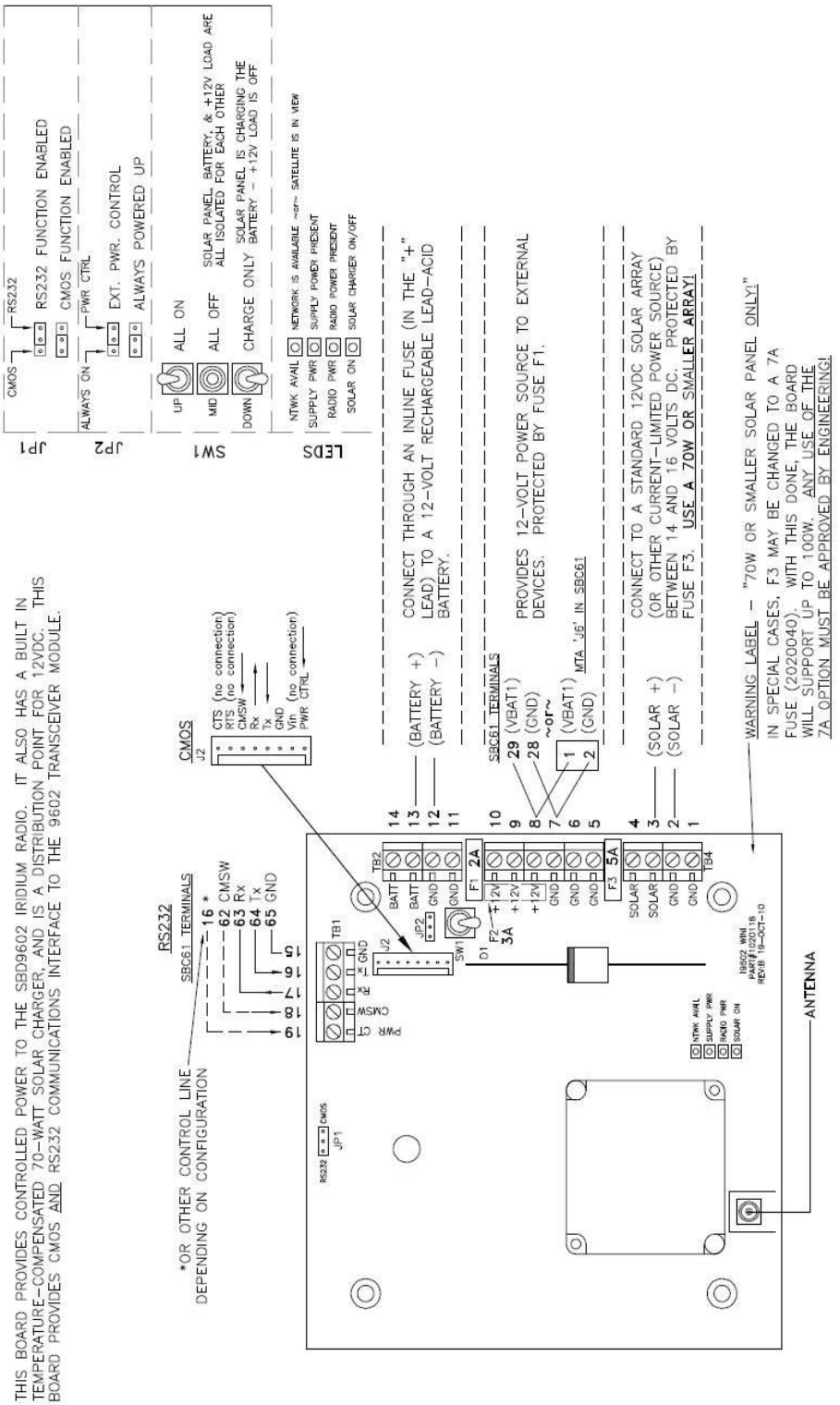


Figure 17 – General Information on I9602 WINI

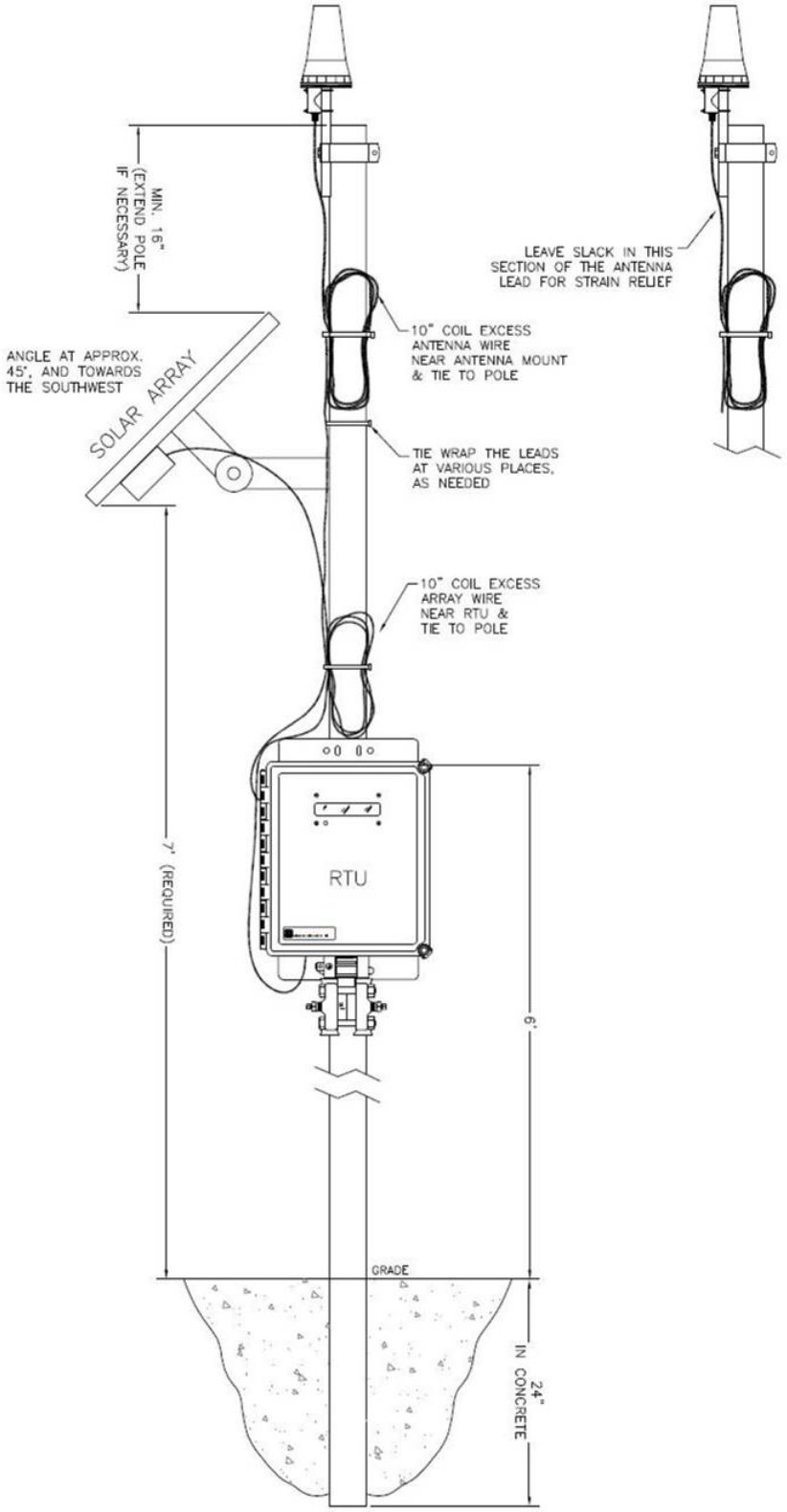


Figure 18 – Installing Antenna for the I9602 WINI and Module